Forintek Canada Corp.

Japan's Value Added Market: Wood Product Attributes and Competition

Competitor Analysis One

prepared for

Forest Renewal BC

FOREST RENEWAL BC

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Summary

The objective of this study is to compare wood product attributes demanded to those that can be profitably and competitively supplied to the Japanese market by the BC primary and secondary wood products sector. Specifically, this includes providing market research and an international trade-flow analysis to highlight areas of competitive advantage for the BC value-added wood products sector.

This is the first of four reports for this project:

1. Competitor Analysis One
2. Attribute Analysis
3. Competitor Analysis Two
4. Linkage Analysis

It was the objectives of Competitor Analysis One to:

- record wood product production and trade flow information with as much product detail as possible, for identified global producers and global suppliers
- identify trends over the 1990's
- develop a methodology to incorporate such product detail into a trade-flow model, with an initial focus on softwood lumber
- offer predicted trade flows for a 1992 base year for comparison against known trade.

These objectives were addressed by recording the global production, trade and value of wood products (softwood/hardwood lumber and logs by species, structural/nonstructural panels, and other further value-added wood products), annually from 1991 to 1997. With the initial focus on softwood lumber, these data were categorized into four product groups on the basis of price. These categories roughly represent a high-end "appearance" grade, a Japanese construction ("J") grade, a US construction grade, and a utility grade. 1992 was used as a "base year" for this breakdown, and applied to a partial equilibrium spacial trade model. The initial results of this analysis are very encouraging, and the value of breaking softwood lumber into rough end-use categories was clearly demonstrated. First, there was a large improvement in trade flow forecasting for the 1992 base year. Second, this demonstrates that it is possible to utilize any level of trade detail in a trade model, a point which is critical for the ultimate Linkage Analysis of this project. Finally, it was shown that the this analysis is an ideal mechanism for organizing existing information and industry knowledge, and will be a valuable tool in the assessment of competitive advantages of BC products (and potential products).

The objective of the Competitor Analysis Two will be to:

- fine tune the softwood lumber product categories
- calibrate the model for known trade in years 1993 through to 1997
- offer base line projections for the year 2000, 2005, and 2010
- offer a scenario analysis
- incorporate softwood logs
- run a similar analysis for all wood panel and other identified engineered products.

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All errors or omissions remain the responsibility of the authors.

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1 Objective

The overall objectives of this project are broken into three categories:

- **The Attribute Analysis**

  The objective of the attribute analysis is to develop and implement a methodology for identifying what wood product attributes are being demanded in Japan for a number of wood product categories, as identified by the project steering committee. In addition to identifying attributes or sets of attributes that are driving specifier's purchase decisions, a trade-off analysis is to be performed (for example, what a specifier is willing to give up if price is to be lowered), as well as a market share analysis (what would be the expected market share of a product with a defined combination of attributes).

- **The Competitor Analysis**

  The objectives of the competitor analysis are broken down into two phases, **with this report detailing the results of phase one**:

  - record wood product production and trade flow information with as much product detail as possible, for identified global producers and global suppliers
  - identify trends over the 1990's
  - develop a methodology to incorporate such product detail into a trade-flow model, with an initial focus on softwood lumber.
  - offer predicted trade flows for a 1992 base year for comparison against known trade.

  The second phase objectives extend the work presented in this report to:

  - fine tune the softwood lumber product categories
  - calibrate the model for known trade in years 1993 through to 1997
  - offer base line projections for the years 2000, 2005, and 2010
  - offer a scenario analysis
  - incorporate softwood logs
  - run a similar analysis for all wood panel and other identified engineered products.

- **The Linkage Analysis**

  The objectives of the linkage analysis are two fold. The first is to translate the attribute analysis into identifiable competitive advantages for BC primary and secondary wood products in Japan. This is both for existing products, and for product modifications. It is hoped that this will be a springboard for product research and development, as well as a valuable tool for BC industry marketers. The second objective is to link the competitor analysis to this matching of attributes demanded to attributes potentially supplied. By using the trade model and industry knowledge, the objective of this analysis will be to identify areas of competitive advantage for BC wood products.

These objectives will be addressed in a total of four written reports: this report, Competitor Analysis One, followed by The Attribute Analysis, Competitor Analysis Two, and The Linkage Analyses.

2 Introduction

The BC forest industry has traditionally focussed on producing primary products such as dimension lumber and pulp. Marketing efforts in Japan have demonstrated potential for increasing profitability through a higher willingness to pay as compared to the US for the product. But this is less so the case today due to Japan's weakening Yen and change in building practices. Continued success now requires appropriate market research. While product research is extremely important, it is of limited use if not backed by the marketplace, demonstrating the economic feasibility of moving up the value chain. Further, with the increased availability and interest in substitutes for BC wood products, it is the *attributes* of a wood product that are being demanded today, not necessarily a distinct product. To be competitive in new, value-added markets and to maintain competitiveness in existing markets, it must be determined what attributes are being demanded for specific end-uses and match these to those wood attributes that BC products can best provide. Once these attributes are identified, it is also essential that there be an understanding of who the global competitors are/will be for these opportunities, and the degree of vulnerability for BC producers of wood products to unknown eventualities in the future.

The primary goal of this project is to identify value-added opportunities in Japan where BC wood products have the greatest potential for competitive advantage, sustainability of the resource, and maximizing the number of jobs created per tree. The project offers a powerful tool for secondary and primary producers in their development of product and market strategies, both for the short and the long terms. The project will also provide a common basis for the industry associations' promotional efforts. Finally, the project will provide a foundation to guide the government in trade (for example, facilitating market access), policy (for example, prioritizing silvicultural investments) and research.

The goals of the project are illustrated in Figure 1, showing the linkage of attributes demanded in Japan to those attributes that BC could now or potentially supply in a competitive way.

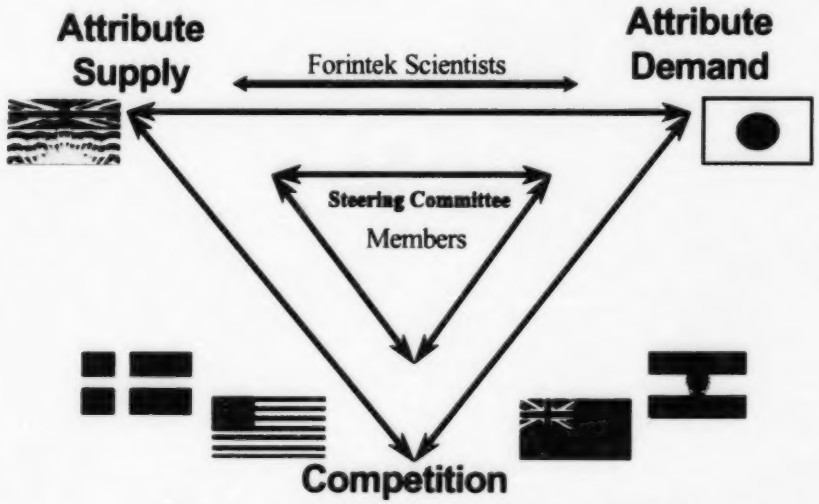

Figure 1 Competitive Linking of Supply and Demand

3 Project Team

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4 Methods

4.1 Data Collection and Organization

4.1.1 Production and Trade Flows

The documentation of historical production and trade of wood products serves two important functions. First, it offers a clear picture of who the players are, both the suppliers and the consumers, and how this has changed over recent years. The identification of production and trade trends can be valuable in itself as a marketing tool for BC products. What market share does BC hold in its major markets, not just for softwood lumber in aggregate, for example, but with as much attention to end-use applications as possible? How has this changed over time? Have new competitors come into the picture? Has there been a change in what BC's major markets are demanding by wood product end-use?

The second reason for documenting production and trade is to create a data base for subsequent trade modelling, to be discussed in Section 4.2.

Before detailing the method of production and trade data collection, it is useful to put BC production and exports of wood products into a global perspective. All of Canada makes up about 7% of the globe's land area. Out of nearly one billion hectares in Canada, roughly one quarter is timber productive (which changes with economic conditions and the state of technology), and an annual harvest which has been around one million hectares annually in recent years (see Figure 2).

In 1995 Canada's growing stock was nearly 25 billion cubic metres, 78% being softwood. BC held 42% of this growing stock (primarily softwood), with an average stand density of over 200 cubic metres per hectare compared to less than 100 for the rest of Canada. In fact, if the Coast and Interior are broken up, one would find that the Coastal average stand density is considerably higher (see Figure 3).

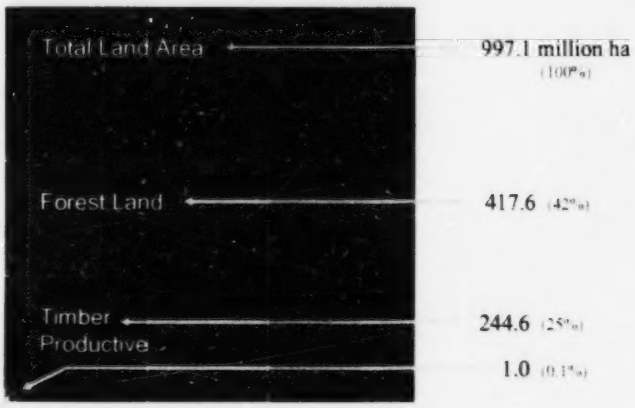

Figure 2 Canada's Land Base

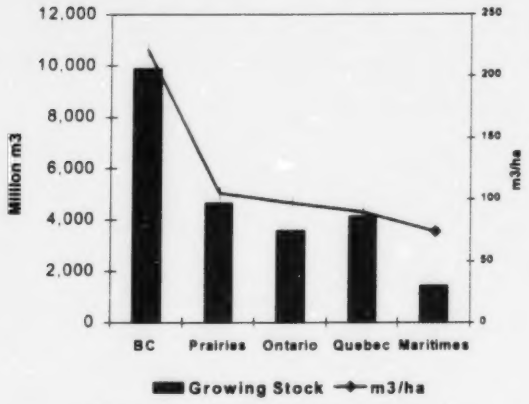

Figure 3 Canada's Growing Stock

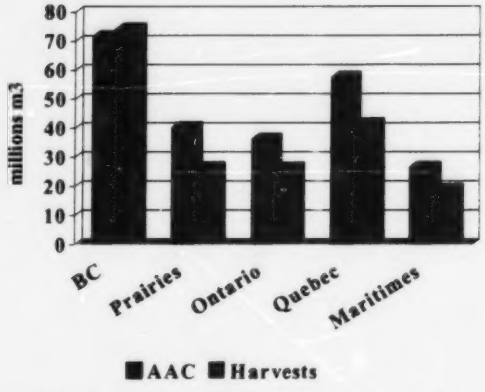

Figure 4 Canada's Timber Harvest

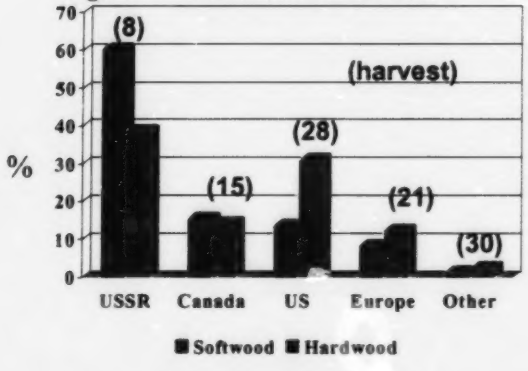

Figure 5 Global Timber Stocks and Harvests

While Canada's allowable cut has been fairly consistent at levels approaching 250 million cubic metres, harvests have increased substantially over time, (the 1995 harvest in Canada was 188 million cubic metres, compared to 115 million cubic metres in 1975). In recent years, however, there has been a drop in BC harvests against continued increases in the rest of Canada. Aside from increases in relative delivered log costs, this reflects that BC has been harvesting at or above its allowable cut whereas the rest of Canada has not (see Figure 4, showing 1995 values).

Putting BC's (and Canada's) growing stock and harvest into an international perspective, Figure 5 illustrates that Canada is a significant supplier of wood products, second only to the US by country. The Figure also shows just how dominant the former USSR is a *potential* supplier of wood products, holding roughly 60 and 40% of the worlds stock of softwood and hardwood timber, respectively. With only 8% of the world's harvest, this shows why the former USSR is the biggest "wild card" in forecasting future wood product supply.

As important as BC and the rest of Canada are as a wood products producer on a global scale, it is even more important in terms of global trade. With a wood product supply that far exceeds domestic demand, Canada is largely export oriented. Canada's exports represent over 50%, for example, of all global trade in softwood lumber (Figure 6). What's more, the only area that comes close, being Europe, largely exports to itself. This has made the forest products industry a key component of Canada's economic growth, with the industry representing the single largest contributor to the trade balance (exports minus imports). In fact, at roughly 35 billion dollars annually, this is larger than energy, automotive, agriculture, chemicals and machinery combined (see Figure7).

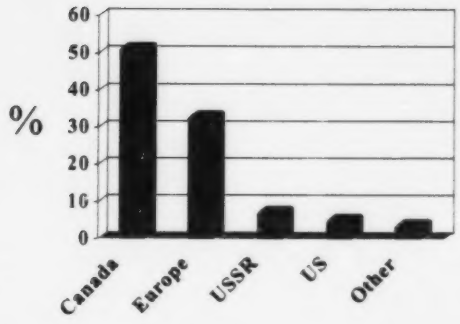

Figure 6 Global Exports of Softwood Lumber

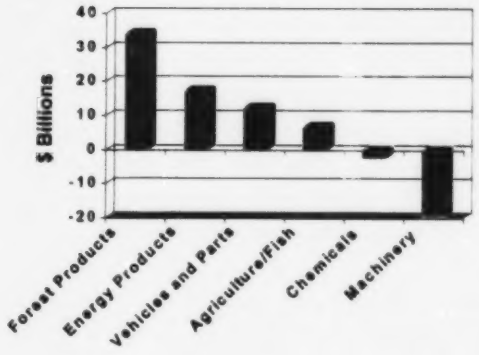

Figure 7 Canada's Balance of Trade

On the demand side for solid wood products, the three most important for Canada are the US (by far), Japan and Western Europe (although the latter has lost its significance with the introduction of the pinewood nematode issue, and Europe's growing self-sufficiency). These three regions represented the vast majority of global softwood lumber trade.

When thought of in terms of modelling wood product trade then, it must be recognized that the vast majority of trade today takes place within only three countries (once eliminating intra-Europe trade): Canada, the US, and Japan. As will be seen in the presentation of trade data detail and the subsequent modelling efforts presented in this report, the greatest attention is paid to these three countries, with Canada as an exporter, Japan as an importer, and the US as a significant exporter and importer.

The considerable trade data that were collected for softwood lumber are summarized graphically in Appendix One. While the overwhelming significance of Canada, the US and Japan is noted for present day, these charts reflect that 7 global supply areas were identified for this study: Canada, US, Scandinavia, New Zealand, Chile, Japan, and the "Rest of World". While Canada as a whole is shown, and used in the first stage of the trade modelling, BC will be broken out for the second phase of the Competitor Analysis. The reason for not breaking out BC initially is that there are trade data complications to contend with. While Statistics Canada reports exports of softwood lumber by province, importing countries do not.

Appendix one also details the imports from 4 identified demand regions. The US, Japan, Western Europe, and "Rest of World". (As a reminder, the second phase of this study will include representation of the production and trade of softwood logs, all panel products and other engineered products to the limit of data availability, both with historical graphical summaries as presented in the appendix for lumber, and with the subsequent trade-flow analysis).

It will be noted that the graphical trade trends shown reveal considerable trade detail, breaking down softwood lumber by species in almost all cases, sometimes by size category (the Japan import data), and sometimes by rough versus green (Japan import data and US export data). It must be stressed, however that

this if the full extent of detail available from public sources. Without trade data by grade, it is not at all clear how to break up aggregated softwood lumber trade into various end-use categories. The approach taken in this study is detailed in Section 4.1.2.

In the balance of this section, the wood production of the three major players (Canada, the US and Japan) is discussed in a some detail, helping to put the subsequent trade analysis offered in the balance of this report in context. A brief overview of Western Europe is also included, even though their trade is largely internal.

4.1.1.1 Canada

The nature of Canada's resource has already been discussed in the previous section. What follows is a summary of how this resource is being used in the context of solid wood production. Figure 8 breaks out the roughly $16 billion of solid wood production in Canada in 1996. The largest production is from BC followed by Québec and Ontario, with the US being the largest market followed by Japan, and lumber being by far the major product. What's more, of the lumber, the most prominent production is SPF commodity dimension lumber, destined to the US (see Figure 9).

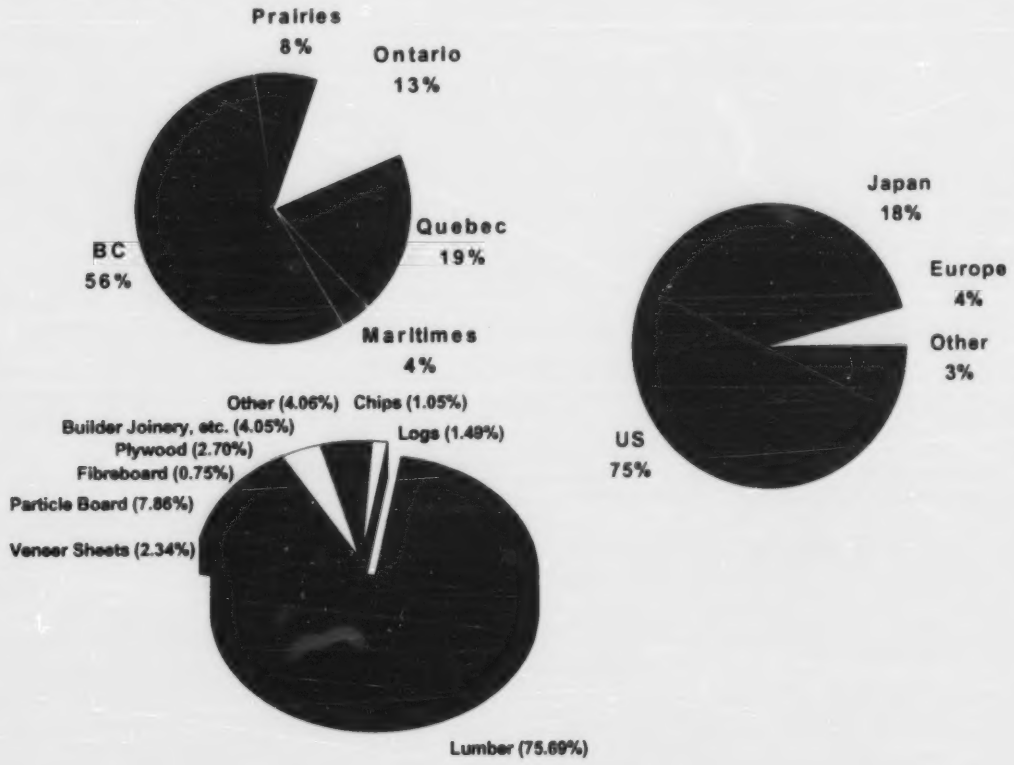

Figure 8 Canada's Solid Wood Production (Source/Type) and Exports by Destination

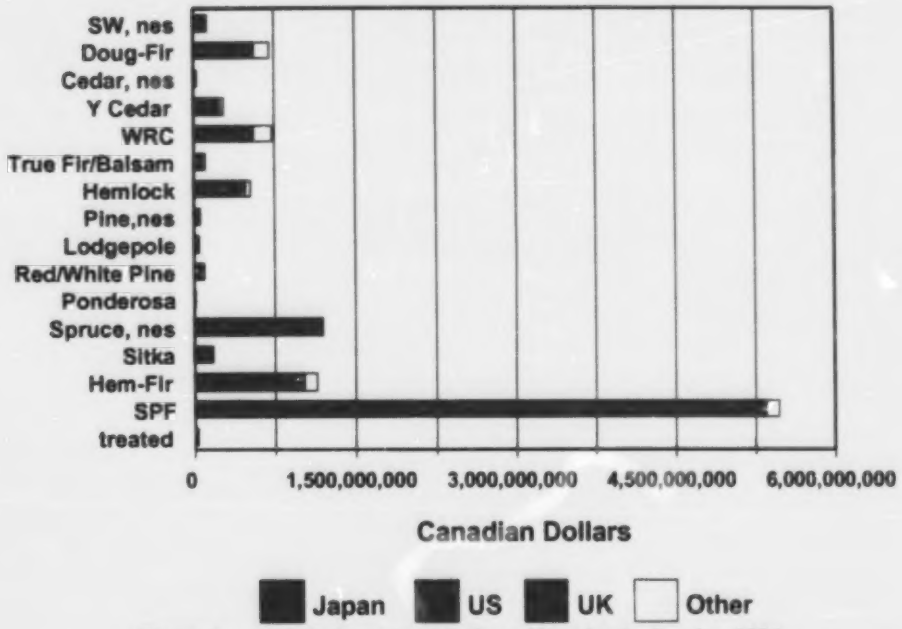

Figure 9 Canada Exports of Softwood Lumber by Species, 1996

If we looked at provincial data, the dominance of production and the ultimate trade of SPF to the US would not be as dramatic for BC. While this is partially the case for the BC Interior, most of the non-SPF species shown in Figure 9 are from the BC Coast, a very large part of which goes to Japan, not the US. Further, even in the BC Interior, a significant quantity is exported to Japan, as "J" grade SPF. As shown in Figure 10, showing FOB BC prices of SPF shipments to Japan and to the US, the former commands a considerable quality premium.

While Canada's wood products industry is very much export oriented, domestic demand is not to be forgotten. Figures 11 and 12 put the exports over time in context to domestic production and shipments within Canada for both BC and Québec as examples. Note the somewhat higher growth in production and distinct increase in the level of exports in Québec as compared to BC.

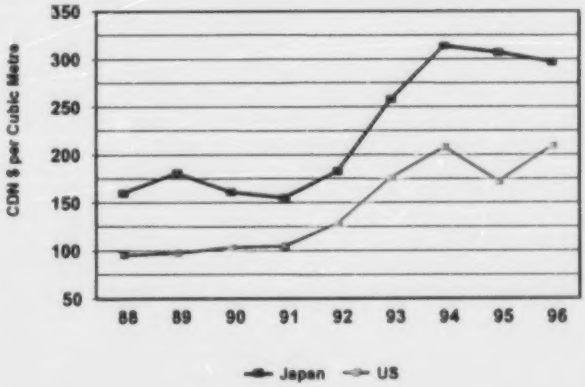

Figure 10 Canada FOB Exports Prices of SPF Lumber

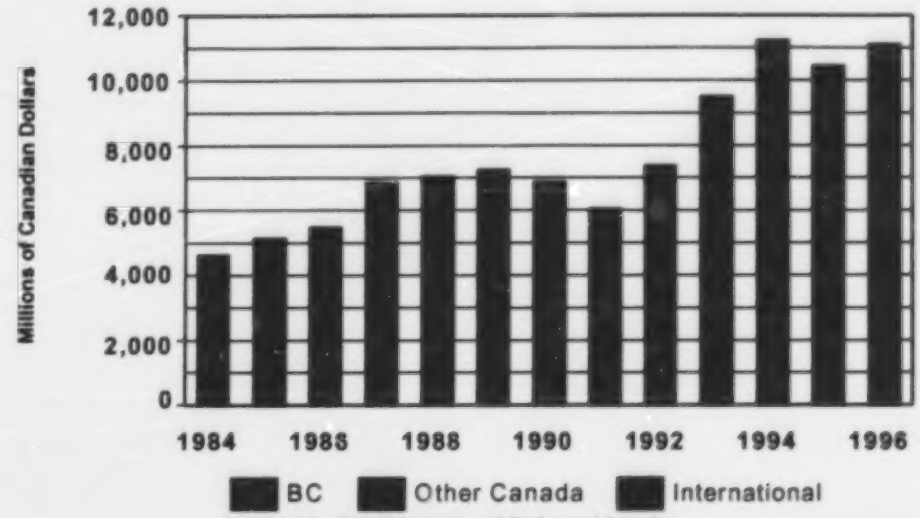

Figure 11 BC Shipments of Softwood Lumber

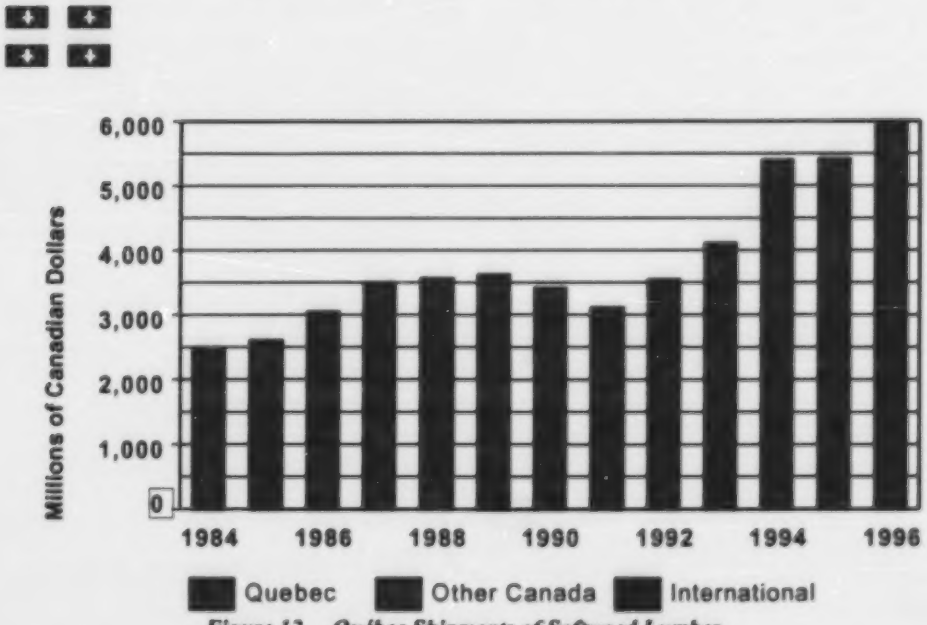

Figure 12 Québec Shipments of Softwood Lumber

If one looks at the US market alone (noting that BC is the largest Canadian supplier to Japan by far), this shift in commodity SPF production to Eastern Canada is even more evident (see Figure 13). One of the strongest driving forces for this, as illustrated in Figure 14, is rising log costs in BC, due in part to increased stumpage costs, but even more to the increased cost of compliance to environmental regulations such as the Forest Practices Code. Eastern Canada is, in fact, now amongst the lowest cost producers of construction lumber in North America. Finally, Figure 15 illustrates that the increased costs are inherent to BC even beyond stumpage and regulatory costs (Sedjo, 1997). As the province moves outward along its extensive margin, moving to less accessible stands and lower quality trees, costs increase. This will be a very important point when looking for areas of competitive advantages for BC in the future, particularly with the introduction of engineered wood products where the only attribute that may be demanded is low cost (fast grown) fibre. As illustrated in Figure 16, this is not an area where BC will want to compete, without significant biotechnology.

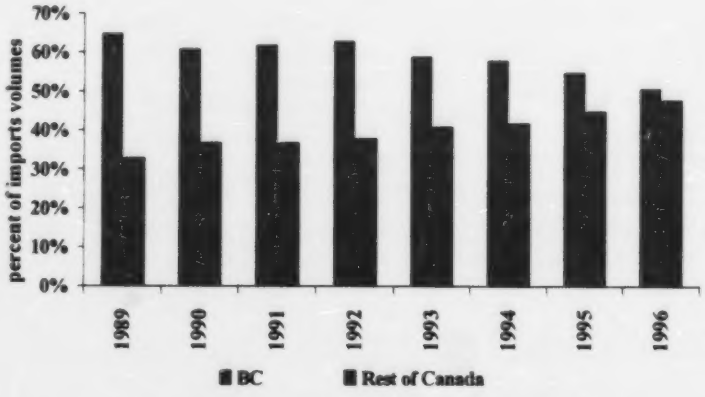

Figure 13 US Imports of Softwood Lumber from Canada

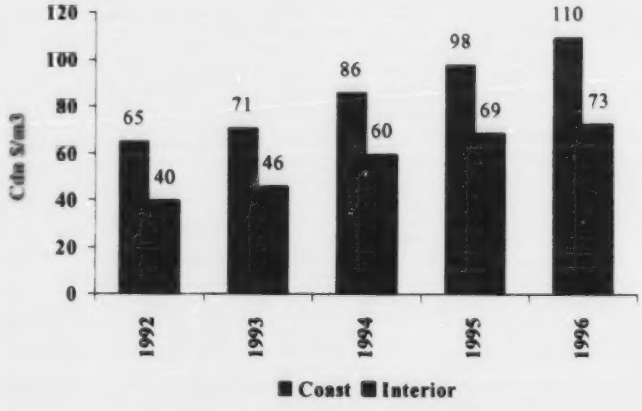

Figure 14 BC Delivered Log Costs

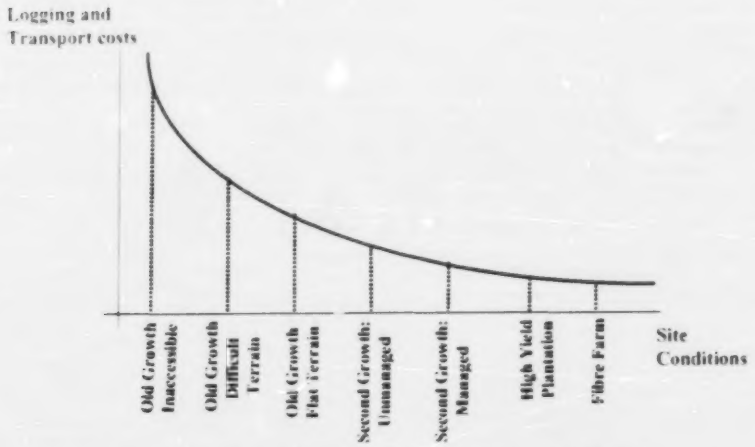

Figure 15 Hypothetical Log Costs By Area and Terrain

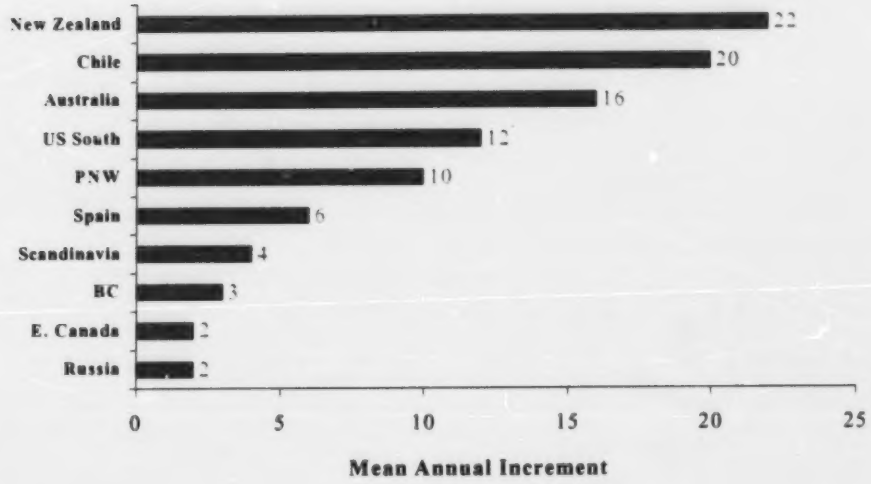

Figure 16 Global Softwood Growth Rates

4.1.1.2 United States

The US has a has timber growing stock of 22 billion cubic metres. Their resource has a heavier component of hardwood, 43% as compared to Canada's 22%. Further, as shown in Figure 17, US lumber production is considerably higher than that of Canada's, with recent peaks to 120 million cubic metres as compared to 65 cubic metres in Canada in 1997. This huge difference in the ratio of growing stock to lumber production between the two countries is explained by the difference in *economically available* growing stock.

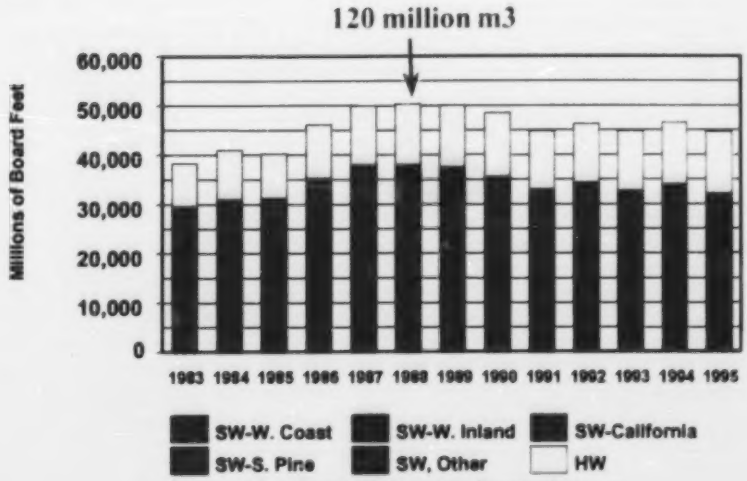

Figure 17 Total US Lumber Production

As can be seen from the figure, the softwood component of this production has been fairly evenly split between the US West and US South historically, but has shifted quite dramatically to the South with the closing of Federal timber lands in the West.

Figure 18 details this shift in lumber production, showing the dramatic drops in Oregon and California in particular, against rises in production in all of the major producing states of the south.

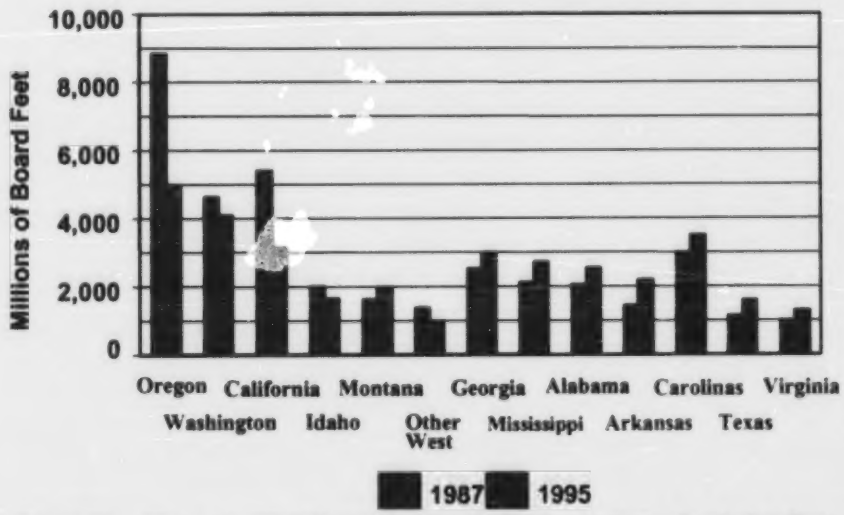

Figure 18 Change in US Softwood Lumber Production by Major Producing State

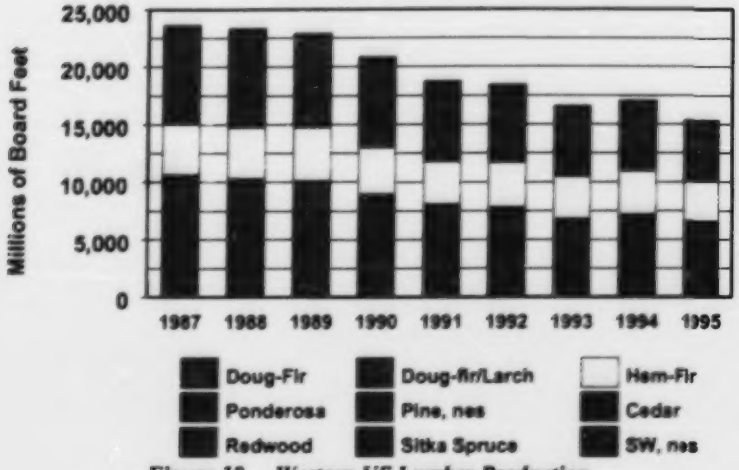

Figure 19 Western US Lumber Production

Figure 19 breaks down lumber production for the US West by species, showing the dominance of Douglas-fir, hem-fir, and ponderosa pine, all of which compete with particularly the BC Coast's lumber in Japan.

The US South is dominated by various types of Southern Yellow pine, and as shown by Figure 20, the production is over 98% for US domestic consumption.

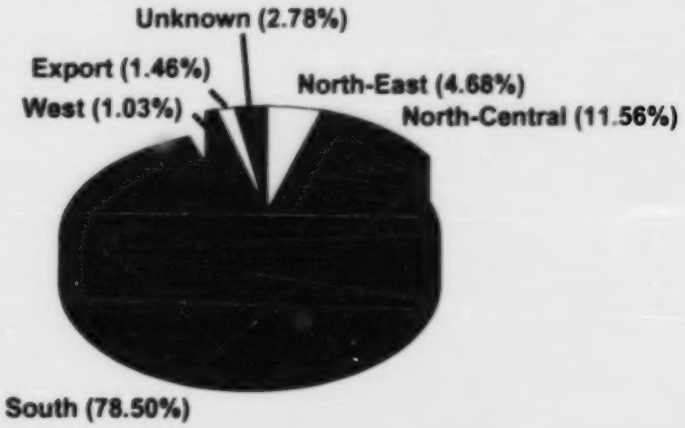

Figure 20. US South Lumber Shipments

As the export data show in Appendix One, while the US is a net importer of wood products they do export significant volumes, especially to Japan. Further while the US has historically been more of a softwood log exporter than lumber, this is changing rapidly with the reduction in harvests from western public lands.

Considerable information is available on the US production of wood products. Unlike Canada, where the primary source of information is from a federal agency (Statistics Canada), the US offers detailed statistics on not only production but intra US shipments by state. In the case of softwood lumber this often includes detail on grade, not just on species. In addition to the USDA Forest Service, the industry associations such as the Western Wood Products Association, the Southern Forest Products Association, the APA-The Engineered Wood Association, the American Forest & Pulp Association and others are all rich sources of production and wood shipments. Tables 1 and 2 give an idea of the magnitude of this information, as examples only. Through the western Wood Products Association and the Southern Forest Products Association, data are available to track lumber production and shipments from state of origin to state of destination by species, product dimension and grade. Unfortunately, this level of detail is not available for US exports offshore.

The US also offers detailed data on wood product end-uses, particularly for new house construction (single and multi-family) through detailed surveys done my the National Association of Home Builders. These statistics detail wood use by size and grade in construction, including engineered wood products. Detail includes use in a wall versus floor, versus siding, etc.

In addition to new housing starts, the US uses almost equal amounts of wood for repair and renovations, as well as non-residential and industrial end-uses (Figure 21).

Table 1 Selected Production Statistics, California

Total Timberland		**Employment**		**Species Cut**	
16,424,000 Acres		*Logging/sawmills/planing*		*Douglas-Fir*	*26.9%*
		116,100		*Ponderosa*	*17.2%*
Volume of Sawtimber				*Hem-Fir*	*25.7%*
		Millwork/plywood/related		*Redwood*	*22.2%*
310,563,000 MBF		*18,200*		*Other*	*8.0%*
Source of Timber		**Degree of Processing**		**Principal Markets**	
National Forest	*11.2%*	*Kiln Dried*	*52.3%*	*California*	*67.1%*
Other Public	*2.8%*	*Air Dried*	*6.8%*	*Other US West*	*17.4%*
Forest Industry	*54.4%*	*Green*	*41.1%*	*US Midwest*	*6.7%*
Other Private	*31.2%*			*US NE*	*2.0%*
Imports	*0.4%*	*Rough*	*29.2%*	*US S Central*	*3.0%*
		Surfaced	*70.8%*	*US SE*	*2.5%*
				Int'l Export	*1.3%*

Table 2 Western US Lumber Production Detail

Douglas Fir, Dry, Surface Finished, US West, Coast. 1996

	mbf	$ US per mbf
FINISH		
5/4 & thicker, D & Btr	1,935	781.87
MOULDING		
5/4 & Thicker, Mldg & Btr	766	1056.47
SHOP		
VG	1,212	867.58
MG	5,754	633.07
LIGHT FRAMING		
2x4 Std $ Btr	29,832	410.54
2x4 Utility	4,617	278.53
2x4 Economy	3,744	135.15
STR LIGHT FRAMING		
1x4 #1 & Btr	6,899	433.39
2x5 #2 & Btr	8,179	444.21
STR JOISTS & PLANKS		
2x6 Select Structural	749	487.44
2x10 Select Structural	1,270	523.83
2x6 #2 & Btr	28,746	435.69
2x8 #2 & Btr	9,513	429.18
2x10 #2 & Btr	30,694	468.62

	mbf	per mbf $ US
JOISTS (cont)		
2x12 @ Wdr, #2 & Btr	29,062	498.38
2x6 #3	5,439	272.40
2x8 #3	1,885	258.60
2x10 #3	2,836	251.65
2x12 $ Wdr, #3	3,341	291.80
2x6 Economy	3,473	149.16
2x8 Economy	1,100	143.68
2x10 Economy	1,435	138.83
2x12 Economy	2,278	147.73
LAM STOCK		
2x4 L3 & Btr	10,232	513.74
2x6 L3 & Btr	26,399	562.22
2x8 L3 & Btr	4,167	558.18
2x10 L3 & Btr	2,466	555.13
STUDS		
2x4 #2 & Btr	1,525	383.48
2x6 #2 & Btr	844	400.01
2x4 Std & Btr	1,566	389.59
2x4 Stud Grade	23,792	375.24
2x4 Stud Grade, 10'	8,458	397.85
2x6 Stud Grade	7,483	391.20
2x4 Utility	903	247.78
2x4 Economy	1,391	137.17

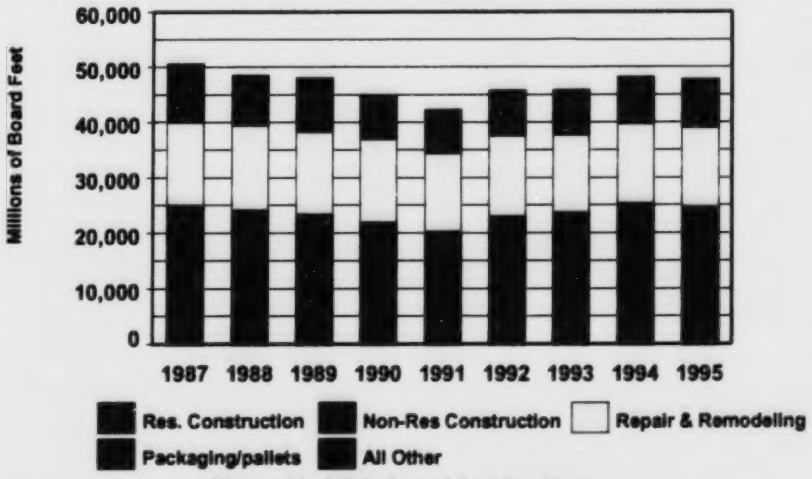

Figure 21 US Softwood Lumber Usage

4.1.1.3 Japan

While Japan is primarily thought of as the second largest importer of wood products, in terms of the competitor analysis being reported, it is critical to note its importance as a supplier as well. While virtually 100% of this supply is consumed domestically, the levels are high and Japanese supply must be viewed as a competition to BC product in this market!

Approximately 70 percent of Japan's 37 million hectares is covered by forests. This may come as some surprise when one considers Japan's high population density. With approximately 125 million people, Japan has a per capita forest area which, at less than a fifth of a hectare, is less than half the world average.

Of the total forest land in Japan, there are 13.67 million hectares of natural forests (54%), 10.22 million hectares of man-made forests (40%), with the balance being either unstocked land or bamboo groves (1.37 million hectares, or 6%). The natural forest area consists of 75% hardwood species, 13% softwood species and 12% mixed forests. The hardwood species include oak, elm, ash, and beech. The softwood species include fir (*Abies veitchii, Abies mariesii*, and *Abies sachalinensis*), spruce (*Picea hondoensis* and *Picea jezoensis*), hemlock (*Tsuga diversifolia*), larch (*Larix leptolepis*), pine (*Pinus densiflora*, or red pine; *Pinus pentapphylla*, or white pine; *Pinus Thunbergii*, or black pine), Hinoki (*Chamaecyparis obtusa*), and Sugi (*Cryptomeria japonica*).

In contrast, 98% of the man-made forest is softwood. Ten percent of the area is larch, 11% is pine, 24% is Hinoki, 45%Sugi, 9% is spruce and fir, and 1% miscellaneous.

The growing stock of the natural forests is roughly 1.5 billion cubic metres compared to roughly 1.4 billion cubic metres in the man-made forests. The man-made forests are primarily a product of extensive planting which took place in the one to two decades following World War II. Annual growth of the plantations is roughly 76 million cubic metres, or a mean annual increment (MAI) of 7.5 cubic metres per hectare. Figure 22 shows the age distribution of these trees.

Japan's annual harvest ranges either side of 30 million cubic metres, with roughly 60% being harvested from the man-made forests. This is down from the peak seen in the 1950s of over 50 million cubic metre. However, as shown in Figure 22, the volume harvested can be expected to increase significantly over the near term.

Forest land ownership is roughly 60% private, 30% national and the remaining 10% under prefecture and community control. The private forests are owned by nearly 3 million individuals, corporations and other organizations. Approximately 90% is owned by individuals, with an average holding of only 2.6 hectares (60% of the private owners own less than one hectare of land). The national forest land base is under the jurisdiction of the Forestry Agency, and tends to be located in the steep mountainous areas (unlike the private, prefecture and community forests, which tend to be located in more economically accessible areas).

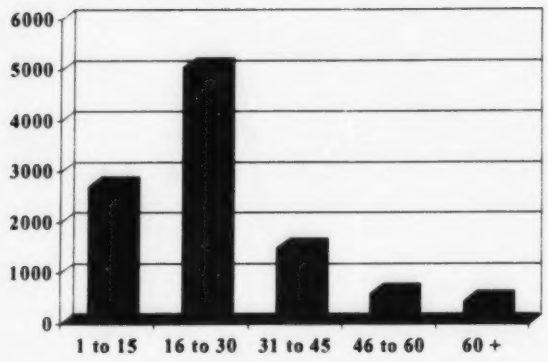

Figure 22 Distribution of Planted Forests in Japan by Age Class, 1986 (Japan Forest Agency)

Japan has a very long history of using wood, particularly for housing. The country's familiar post and beam construction has created a demand for wood which has both structural strength and appearance qualities. The importance of this combination lies in the visually exposed vertical pillars joined to exposed horizontal beams and girders.

The domestic timber of choice for the pillars, due to their combined strength and high appearance characteristics has historically been Hinoki (Japanese cypress) and Sugi (Japanese cedar, or Cryptomeria). For beams, Akamatsu (Japanese red pine) has often used for its ability to handle large shearing stress. Foundations have often been made from Hinoki due to natural rot-resistant properties. Sugi heartwood has often used for panelling due to its decorative colour. Sugi has also been used for ceiling boards due to its light weight. Overall, it is the Hinoki that has been the species most valued by the Japanese, even in ancient times.

Aside from the Japanese demand for wood used in post and beam construction, there has been a growing demand for wood suitable for platform-frame and prefabricated housing construction. The wood imports most suitable for these housing types include North American S-P-F and other dried, planed, dimension softwood lumber, as well as panel products. Largely due to the marketing efforts of the Canadian Council of Forest Industries in the mid 1970s, platform frame starts rose from zero in 1975 to nearly 94,000 in 1996, representing 12.4% of all wood starts. Prefabricated housing construction was introduced in the 1950s, and by 1996 represented just over 5.5% of wood starts. It should be noted that this does not include non-wood prefabricated start. Once again, planed, dimension lumber and panel products have historically been demanded for this housing type.

Interestingly, hardwoods in Japan do not typically get used for decorative purposes. In fact, hardwoods are primarily used as pulp furnish or other woodchip products, followed by their use in plywood manufacture. An estimated 35% of Japan's plywood consumption is for the manufacture of concrete forms, with most of the balance being used as sheathing in construction for walls, floors and roofing (Sedjo, *et al.*, 1994).

Combined with softwood, over 60% of the domestic industrial timber in Japan has historically been used for lumber, followed by roughly 30% for pulp and wood chips combined, and a small percentage for veneer sheets for plywood and other miscellaneous products.

One of the distinctive features of lumber demand in Japan is that in addition to the quality of the wood, dimensions have been critical. Not only are the dimensions demanded inconsistent with North American standards, for example, but they can change from one region in Japan to the next, or even from one building project to the next (Sedjo, *et al.*, 1994). This partially explains a history of thousands of local mills producing to meet highly localized demand conditions. This is, of course, changing dramatically with the growing use

of factory precut housing components and hybrid house types (between traditional post and bean and platform frame construction).

As roughly 80% of domestic lumber shipments go into housing construction in Japan, a look at housing starts over time can be quite instructive. Figures 23 and 24 show the trends, with the latter looking at platform frame starts in greater detail.

The rapid growth in housing starts throughout the 1960s and early 1970s due to the rapid economic growth Japan was enjoying over this period. As stated earlier, domestic wood production also increased through much of this time.

From the mid-1970s to the early 1980s this economic growth slowed and ultimately declined, spurred by the "oil crisis" of 1973. After 1986, economic activity stabilized and began to show modest growth (as did housing starts). Housing starts remained in this 1.5 million area ever since, until the present year, with housing starts expected to drop as low as 1.2 million due to present economic conditions.

It must be pointed out that these levels of starts are extraordinary, due in part to pent up demand (housing standards that are not commensurate to per capita wealth), and in part to short home lives. Japan's housing starts are typically higher than the US, with little more than a third of the population!

It is interesting to note that the population in Japan has not changed significantly over the past several decades. During the 1960s, population increased by an average of 1% per year, peaking at roughly 2% in 1970. Ever since then the rate of population growth declined, being roughly 0.5% per year in 1989.

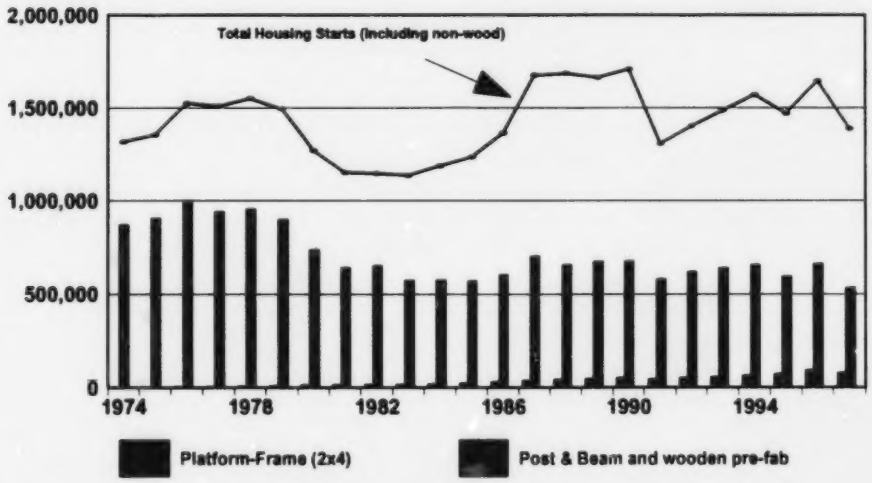

Figure 23 Japan Total Housing Starts

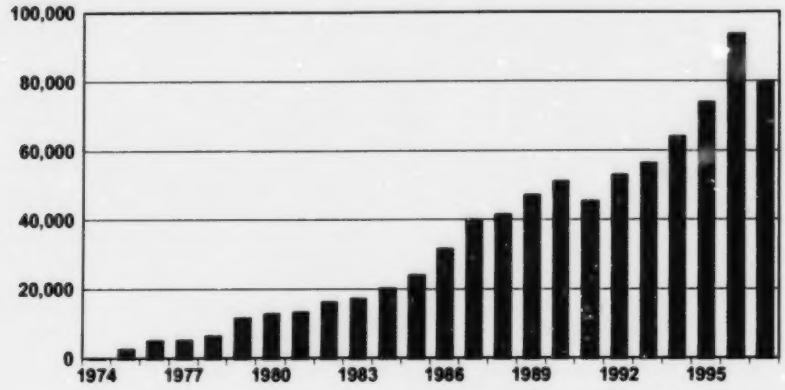

Figure 24 Japan Platform Frame (2x4) Housing Starts

As important as Japan's domestic production of wood products has been throughout much of Japan's history, due to demand that exceeded domestic supply and fuelled over three decades of increasing purchase power of the Yen, Japan has become highly reliant on wood product imports. As can be seen by Figure 25, Japan has moved from a situation of almost total self-sufficiency in wood products (95% of Japan's total industrial wood supply in 1955 came from domestic production) to a very strong reliance on imports (only 25% of Japan's total industrial wood supply in 1993 came from domestic production).

It is also obvious from Figure 25 that Japan has shown a strong preference for importing logs rather than lumber. In 1965, 84% of all solid wood imports by value (logs, lumber, panel and other further manufactured products) were in the form of logs. In spite of this strong preference for logs, however, by 1993 log imports as a percentage of total solid wood products had decreased to 44% (Japan Tariff Association), while lumber imports increased from 15% to 33%. This is not likely reflecting a change in Japan's demand, rather increased restriction on log exports by particularly hardwood log suppliers.

Lumber imports, like logs, have also seen a shift away from hardwoods in favour of softwoods. In 1962, only 11% of lumber imports were softwood, as compared to 85% in 1993, and with roughly 15 times the volume of lumber imports in 1993 as compared to 1962.

There is a difference in Japan's end-use mix of domestic and imported logs. 60-70% of Japan's domestic logs are used for lumber, with the balance being used primarily for pulp and wood chips, and small amounts for veneer, fibreboard, scaffolding, and other miscellaneous uses. Virtually 100% of the imported logs from North America, the former Soviet Union and New Zealand, by contrast, are used for lumber production. On the other hand, imported logs from the South Seas countries are primarily used for veneer, with less than 20% being used for lumber (Japan Forest Agency).

Roughly 80% of lumber made from domestic logs go into housing construction, as is the case for lumber processed from North American and USSR log imports. In the case of lumber produced from South Sea logs, however, only 45% went into housing, while an additional 20% went into packaging and the remaining 35% into furniture and other miscellaneous uses. The vast majority (over 80%) of the lumber made from New

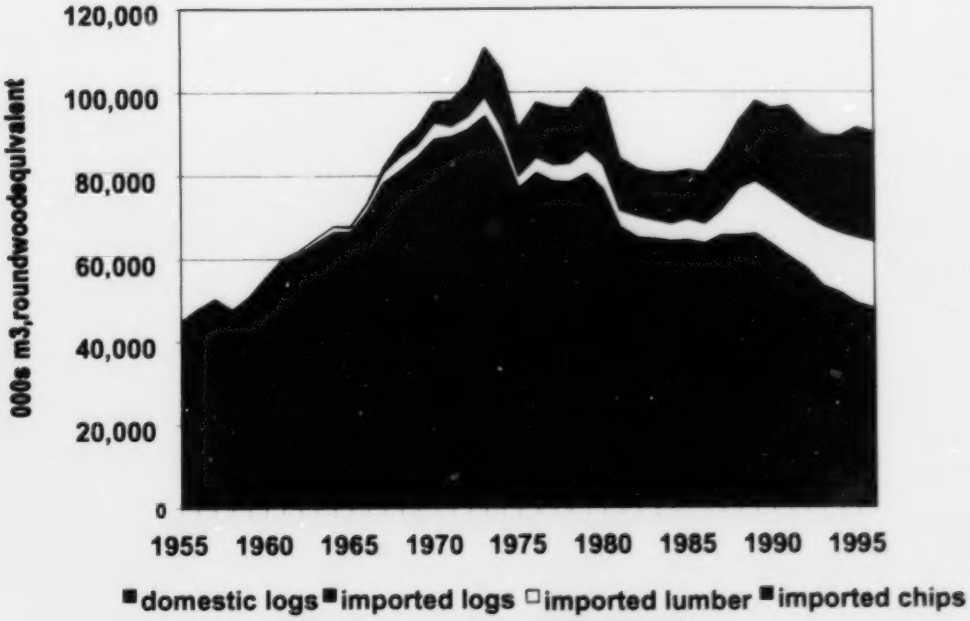

Figure 25 Japan Industrial Wood Supply

Zealand logs have historically gone into packaging.

As of the end of the last decade, there where over 17,000 sawmills in Japan (keep in mind the earlier comments made regarding sawmill's historical tendency to produce to very specific localized conditions). Given lumber shipments of approximately 30 million cubic metres at that time, this gives an overall average output of only 1,750 cubic metres (roundwood equivalent) per mill. Of these sawmills, approximately 40% process domestic logs only, approximately 15% process imported logs only, and the balance process both (Otsuka, 1992).

Although the average sawmill size is small, especially by BC standards, they range significantly in size. Those mills that utilize predominantly (or only) domestic logs are generally small family operations employing less than 10 people. These tend to be inland mills located close to the timber source. While this makes up the majority of sawmills by number in Japan, those that process predominately imported logs tend to be considerably larger. These are usually either coastal mills, or mills located close to large urban centres.

Logging and sawmilling typically are not integrated in Japan. Sawmills purchase domestic logs directly from the landowners, independent log producers, forestry cooperatives or sawlog markets (which number in the hundreds). Imported logs are mostly purchased from trading companies and wholesalers. Logs from the national forests in Japan are sold competitively (Kato, 1982).

There are many sources in the literature which state that Japan's domestic log suppliers have difficulty competing with imports on price (see, for example, Sedjo, *et al.*, 1994; Otsuka, 1992; Iwai, 1986). In the case of Japanese cypress, for example, the stumpage cost alone averaged over 40,000 Yen/m^3 in 1990 (approximately $325 US), or a total cost of producing a domestic log of roughly 55,000 Yen (approximately $425 US) (Otsuka, 1992). This compared to the average import price for US hemlock logs (a competing species) of less than 27,000 Yen in 1990 (or less than $210 US) (Japan Tariff Association). Reporting Japanese cypress log costs a decade earlier, Mochida (1984) quotes an even higher price of over 53,000 Yen/m^3 stumpage and a total log cost of over 65,000 Yen/m3 .

While it appears that imported lumber is also less expensive than domestically produced lumber, the higher cost of shipping lumber reduces the price differential. Otsuka (1992), quotes three price comparisons for lumber from a study done by the Forest Products Research Institute in Japan. These comparisons are for the production of posts in 1990. The final cost of these posts in Japan when domestic cedar logs were used was 54,800 Yen/m^3; when North American hemlock logs were used, 48,400 Yen/m^3; and finally, the cost of imported North American hemlock lumber was 43,000 Yen/m^3. In terms of US dollars, these values are approximately $420, $375 and $330/$m^3$, respectively.

When looking at the price of lumber produced in Japan relative to imports, however, it is not clear, due to inconsistencies in dimension and other measures of quality, that the two are as comparable as is the case with logs. Further, Japan reportedly subsidizes domestic production to a considerable extent, making even direct comparisons difficult.

Finally, with any look to the future, one must consider the possibility of a continuing decline of the Yen from recent years, and what this may mean for increased competition for BC wood products from Japanese domestic production.

4.1.1.4 Western Europe

The European forest resource covers approximately 162 million hectares, or about 30 percent of the land area of Europe. The Nordic and Baltic countries and Central Europe have a higher proportion of the forest cover while southern Europe and some areas of the north-west (such as the UK and Netherlands) have forest cover that is below the regional average. The majority of Europe's forestland is managed, with a full 85 percent considered exploitable with no legal, technical or economic restrictions on production. The growing stock of European forests has been increasing ever since the 1950s. This as allowed Europe to become more self-sustainable in their production of wood products. Figure 26 illustrates the increase in growing stock for selected European regions compared to BC.

Imports of softwood lumber into Western Europe from non-European countries have declined substantially over time (see Figure 27). There are numerous reasons for this reduction, however increased reliance on domestic supply coupled with policy changes (trade barriers) and relative currency values (e.g., Sweden devalued its currency in 1992) have decreased the market share of Canada, the US and other non-European exporters.

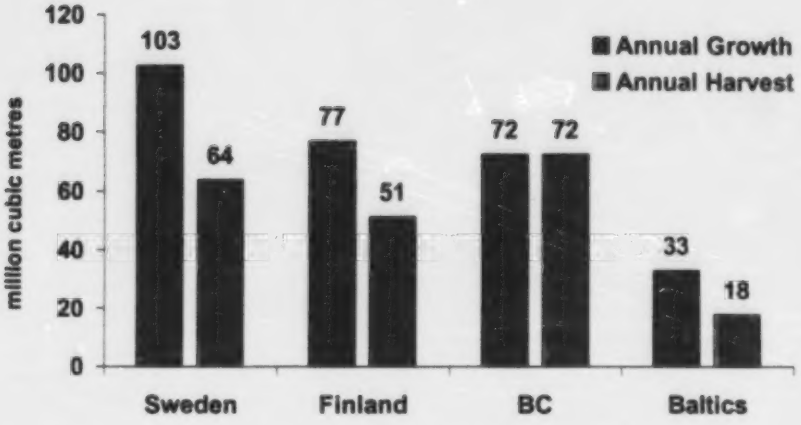

Figure 26 Comparative Growth and Harvest Rates of Selected Countries, 1995

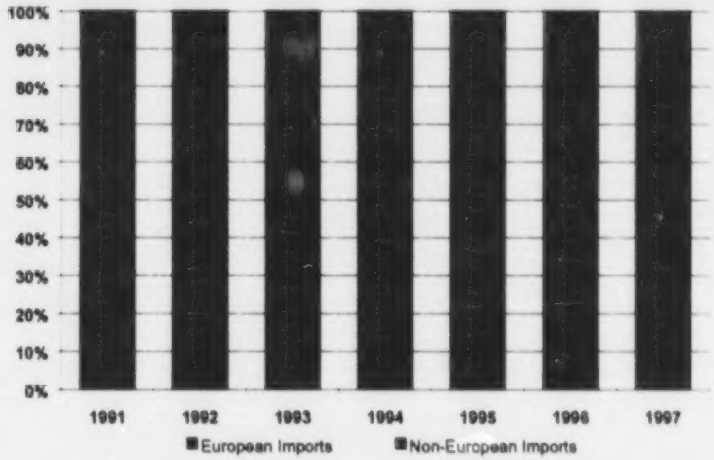

Figure 27 Western European Import Shares by Value

4.1.2 Categorizing and Reconciling the Trade-Flow Data

While the previous section has clearly pointed out the dominance of Canada, the US and Japan in the trade of softwood lumber (recognizing that countries in Europe largely trade amongst one another), for the trade modelling effort undertaken in this study it is important to document the emerging suppliers and the possibility of renewed trade to western Europe. For this reason, eight supply regions have initially been identified: Canada (with BC to be broken out in Competitor Analysis Two), the US, Scandinavia, New Zealand, Chile, the Baltics, Russia, and "rest of world". In addition, four demand regions have been identified: the US, Japan, Western Europe, and "rest of world". Appendix One offers trade-flow data that represent all of these regions.

For the purpose of trade modelling, the objective of categorizing these data is to group softwood lumber into "like" baskets. This addresses a very limiting flaw of existing trade-modelling efforts which can be found in the literature, which is to lump all softwood lumber into one big aggregate. This is a flaw as it makes the huge assumption that softwood lumber is a homogeneous commodity—that, in the eyes of the Japanese specifier, sitka spruce from the BC Coast is a *perfect substitute* for New Zealand Radiata pine. As this is obviously not the case, this study had a underlying objective to get away from this assumption and to model trade flows of "like" softwood lumber, one at a time.

While this sounds like a logical approach to follow, limitation of existing production, import and export data do not make this easy for the researcher. In spite of all of the detail reported in Appendix One for Canadian and US exports against Japan imports (in particular), both by volume and unit value, in many ways it falls short of performing this task of separating lumber into "like" baskets. These data mostly offer species detail, in some case a rough size breakdown or whether or not the lumber is green versus planed/dried. But consider the variation in end-uses that exist within one of these categories. Douglas-fir lumber exports by the US, for example, may be an average of very high grade decorative pine lumber and a low-end structural grade (Figure 28 illustrates).

Figure 28 US-PNW Douglas-fir Clear, Merch., and Structural & Ponderosa Pine Select Prices

In spite of the limitation of these data, they do offer a richness that most researchers choose to ignore in their lumping of all softwood lumber into one. They do recognize that even a species breakdown can be of value, *especially* when combined with knowledge of its source. At the very least, it removes the assumption that even SPF from BC is identical to say larch from Russia. They are not the same and they should not be modelled as if they were!

But how to create the baskets of "like" lumber? Sorting by species alone is problematic, due to both the number of species and the variation that exists geographically.

The approach taken in this study was to **categorize the lumber traded on the basis of price**. Four price categories were chosen with the aim of separating out the "appearance" grade lumber, a Japan "J" construction grade lumber, a US construction grade lumber, and a utility/econo grade lumber. The reason for including two grades of construction grade lumber was to separate the quite dramatic differences which exist between the two. For example, if a Canadian shipper was to divert "J" grade SPF to the US market, it would likely be allocated as MSR lumber or lumber for the Do-It-Yourself market where a premium would be sought for the lack of falldown. Conversely, if this same shipper tried to divert US construction grade lumber to Japan, it would either be rejected, or accepted only as utility grade lumber. Either way, these are NOT competitive products, and should not be treated as such in a trade model.

The categorization of the data, then, was performed on as much trade detail as could be found, as summarized in Appendix One, breaking the exports or imports into one of the four categories based on the export (FOB) or import (CIF) price. This process recognized, of course, that the levels should differ by "apparent" transportation costs. The "law of one price" in economics tells us that a "like" product in BC should differ in its FOB price to the Japan's CIF price by the cost of getting it there, and duties or tariffs, etc. Such a price grouping should also recognize that it must change depending on what year you are talking about; if the lumber price goes up from one year to the next, so to should the price groupings.

The "base year" used for the modelling efforts reported in the next section is 1992. The "base location" for the purpose of the price breakdowns is Canada FOB. The values are CDN $300 or higher for the appearance grade (in 1992), $150 to $299 for the Japan "J" grade, $100 to $149 for the US construction grade, and less than $100 for the utility/econo grade. For the Japan breakdown, $40 was added to all these prices to represent an estimate of "apparent" transportation, the law of one price. Similarly, for the US $10 was added to the Canada groupings (see Figure 29). All other countries were also adjusted accordingly. When it came to categorizing the trade data in subsequent years, these price ranges were adjusted by the difference between the average price of softwood lumber in that year to the 1992 average.

Japan	Canada	US (Importer)
#1 $340 +	#1 $300 +	#1 $310 +
#2 $190 - $339	#2 $150 - $299	#2 $160 - $309
#3 $140 -$189	#3 $100 -$149	#3 $110 -$159
#4 < $140	#4 < $100	#4 < $110

Figure 29 Price Groupings for Lumber Categories by Location

Table 3 offers an example of how this was done, using the case of US lumber exports to Japan in the 1992 base year. In the table, the code column refers to the 4 lumber categories, from "1" as the appearance category to "4" the utility/econo category. The table is actually a representation of a spreadsheet, where these numbers are displayed in calculation, for ease of adjusting the lumber categories.

The summary of all the lumber breakdowns by category are shown in the bottom of the table, showing the majority of US exports in the J-Grade category, plus considerable appearance grade lumber exports.

All of the lumber export values shown in purple in the table are dried/planed lumber exports. These are *not* the original values as reported my the US Department of Commerce. The reason for this is that the US Department of Commerce, as does Statistics Canada, reports all dried/planed lumber exports in *nominal* volumes. That is to say, in their conversion to cubic metres, they are assuming a dried/planed 2x4 truly is 2 inches by 4 inches, as opposed to the *real* 1 ½ inches by 3 ½ inches. Given that the corresponding Japanese import statistics are reporting *real* volumes, this is problematic in reconciling trade volumes, and just as importantly, trade unit values.

For this reason, the numbers in purple have been converted to real volumes and unit values by difference. It was assumed that the Japan volumes are correct, and applied to the US export values by adjusting only the numbers in purple. This resulted in a nominal/real conversion rate that is very close to what one would expect as an average over all dimensions of lumber. (See Forintek Canada Corp., 1985; "Conversion Factors for the Forest Products Industry in Western Canada".)

This process of recording trade data by detail and then summing into categories (the red numbers in the table) was repeated for each of the eight exporters and the four importers and reconciled, all for the 1992 base year. With this complete, and adding necessary production categorization assumptions, the needed input for the initial trade modelling efforts was available.

4.2 Partial Spatial Equilibrium Trade Modelling

From the graphs offered in Appendix One and the previous discussion, a number of trade trends can be identified. While useful in itself, there is a high degree of uncertainty that these trends will continue over time. Who would have imagined, for example, that engineered posts and beams would become so important in Japanese home construction, or that suppliers such as Scandinavia and Austria would be competing with Canadian supply? A look at product production/trade flow trends five years ago would not have alerted Canadian producers to this eventuality.

Trade modelling is one way to help address this situation, taking existing production/trade flow information and enriching it with the powerful ability to ask "what-if" questions against base-line predictions based on the flow trends themselves. The reason that Scandinavia is competing so well in Japan, for example, is a result of a number of now known trends. These are a combination of a change in Japanese demand (a move toward performance attributes and price at the expensive of solid old-growth product), Scandianian/Japanese exchange rate advantages relative to Canada, transportation cost reductions due to favourable "back-haul" arrangements, and others. Is it enough to simply extend these trends into the future? "What if" the Scandinavians lose their exchange rate advantage? What if the Japanese willingness to pay for their product changes in favour of a yet unknown product? What if the Russian Far East timber supplies become more economically available? What if the Japanese change how they view plantation Radiata pine? What if

Table 3 Example of Lumber Trade Classification, US Exports, 1992 Base Year

1992
US Lumber Exports

Japan

	Quantity	US$	$us/m3	cdn$/m3	CODE
WOOD SAWN LENGTHWISE, TREATED, OVER 6MM CONIFEROUS	3,025	287,948	95	114	3
MIXTURES OF SPRUCE PINE FIR (S-P-F) WD OV6MM NT TR	1,109	173,958	157	188	2
MIXTURES WESTERN HEMLOCK/AMABILIS FIR (HEM-FIR) ETC	232,705	41,857,635	179	215	2
SITKA SPRUCE WD SAWN LTHWSE OV 6MM NT TREATD ROUGH	40,159	13,745,459	342	411	1
SITKA SPRUCE WOOD SAWN LTHWSE OV 6MM NT TREATD NES	5,650	1,214,377	215	258	2
SPRUCE NESOI WD SAWN LTHWSE OV 6MM NT TREATD ROUGH	72,940	13,107,469	180	216	2
SPRUCE WOOD NESOI SAWN LTHWSE OV 6MM NT TREATD NES	12,607	3,188,968	253	304	2
ESTRN WHT/RED PINE WD SAW LNGTH OV6MM NT TREAT RGH	126	23,980	190	228	2
ESTRN WHT/RED PINE WD SAW LNGTH OV 6MM NT TRT NESO	629	122,369	195	233	2
LODGEPOLE PINE WD SAW LENGTHWSE OV6MM NT TREAT RGH	1,850	232,724	126	151	3
LODGEPOLE PINE WD SAW LENGTHWSE OV6MM NT TRT NESOI	22,359	8,362,600	374	449	1
PITCH PINE ETC WD SAWN LENGTHWSE OV6MM NOT TRT RGH	2,039	717,870	352	422	1
PITCH PINE ETC WD SAW LENGTHWS OV6MM NOT TRT NESOI	3,560	1,237,020	347	417	1
PONDEROSA PINE WD SAWN LNGTHWS OV6MM NOT TREAT RGH	7,576	1,868,702	247	296	2
PONDEROSA PINE WD SAWN LNGTHWS OV 6MM NOT TRT NESO	24,080	8,659,998	360	432	1
PINE WOOD NESOI SAWN LNGTHWISE OV 6MM UNTREATD RGH	1,917	488,877	255	306	2
PINE WOOD NESOI SAWN LNGTHWS OV 6MM UNTREATD NESOI	4,356	1,134,990	261	313	1
Total Pine	68,491	22,849,130	334	400	
DOUGLAS-FIR LUMBER MIN DIMENSN <5.1CM NT TRT ROUGH	82,579	18,028,772	218	262	2
DOUGLAS-FIR LUMBER ROUGH OV 5.1CM <12.7CM NT TREAT	144,184	39,569,913	274	329	1
DOUGLAS-FIR LUMBER ROUGH 12.7CM OR OVER NOT TREATD	238,778	47,901,706	201	241	2
DOUGLAS FIR LUMBER, NOT TREATED, NESOI	288,391	87,925,565	305	366	1
Total Doug-Fir	753,912	193,425,956	257	308	
FIR WOOD SAWN LENGTHWISE OV 6MM NOT TREATED, ROUGH	17,740	3,141,857	177	213	2
FIR WOOD SAWN LENGTHWISE OV 6MM NOT TREATED NESOI	64,529	24,270,258	376	451	1
HEMLOCK LUMBER OV 6MM THICK NOT TREATED, ROUGH	452,592	83,969,491	186	223	2
HEMLOCK LUMBER, OVER 6 MM THICK, NOT TREATED NESOI	270,005	66,457,769	246	295	2
LARCH WOOD SAWN LENGTHWSE OV6MM NOT TREATED, ROUGH					
LARCH WOOD SAWN LENGTHWSE OV6MM NOT TREATED, NESOI	212	31,606	149	179	2
WESTERN RED CEDAR WD SAW LNGTHWS OV6MM UNTREAT RGH	3,399	845,525	249	299	2
WESTERN RED CEDR WD SAW LNGTHWS OV6MM UNTREAT NESOI	1,942	941,351	485	582	1
YELLOW CEDAR WOOD SAWN LGTHWSE OV6MM UNTREAT ROUGH	784	168,545	215	258	2
YELLOW CEDAR WD SAWN LENGTHWSE OV6MM UNTREAT NESOI	119	59,503	499	599	1
CEDAR WOOD NESOI SAWN LNGTHWS OV6MM UNTREATD ROUGH	10,616	3,673,475	346	415	1
CEDAR WD NESOI SAWN LENGTHWSE OV6MM UNTREATD NESOI	6,936	3,278,360	387	440	1
REDWOOD WOOD SAWN LENGTHWISE OV 6MM UNTREATD ROUGH	2,618	1,552,671	593	712	1
REDWOOD WOOD SAWN LENGTHWISE OV 6MM UNTREATD NESOI	2,705	1,569,298	580	696	1
CONIFEROUS WD NESOI SAWN LNGTHWS OV6MM UNTREATD RGH	66,748	12,552,969	188	226	2
TOTAL SW	2,093,543	492,164,578	235	282	

	m3	$US	$US/m3	$CDN/m3
1	620,573	196,698,331	317	380
2	1,468,095	294,945,577	201	241
3	4,875	520,670	107	128
4	0	0		
	2,093,543	492,164,578	235	282

Canada develops a product which more closely matches the Japanese customers expectations? What are the likely trade flow/price implications of all of these possibilities? Trade flow models offer a mechanism for addressing such questions.

Describing the workings of trade models require a basic understanding of a few key economic theory concepts. It is perhaps easiest to illustrate graphically, utilizing linear supply and demand relationships or functions (supply and demand "curves"). Starting with the simple case of a non-spatial trade model represented in Figure 30, the left panel (Region B) shows a hypothetical demand and supply relationship for, say, western red cedar lumber. The Y-axis represents price and the X-axis quantity demanded or supplied. Note that the demand curve is downward sloping, showing that as the price goes up consumers demand less (for example, moving from point "C" to point "A"). Similarly, the supply curve is upward sloping, reflecting producers' behaviour of wanting to supply more as the price goes up (for example, moving from point "C" to point "B"). In the absence of any trade with areas outside of Region B, an equilibrium point exists at point "C", a theoretical point where both buyers and sellers are equally happy. The resulting quantity sold by the suppliers to the demanders is Q^b and the corresponding price is P^b.

In the far right frame, the same situation is graphed for the same product but for a different area (Region A). Note that in this case, again assuming that there is no trade, that the equilibrium price is considerably higher than that of Region B's. (This exact situation, by the way, is what many would argue exists for Canadian logs: exports are restricted, leading to a situation where Canada's [Region B's] log prices are lower than in other regions or the "world market".)

Next, imagine what would happen if these two regions were not isolated, and that trade was allowed between them. Assuming further that the cost of moving the lumber from one market to the other is zero, a new equilibrium price would be discovered, P^*. At this higher price for Region B quantity demand by domestic consumers would decrease to Q^1. But suppliers would now be willing to sell Q^2 units of lumber, up considerably from the no-trade equilibrium point. In short, with the new "world market" price Region B has an excess supply (ES) of AB in the figure (Q^2 minus Q^1).

Region A, on the other hand, has the opposite situation. The world equilibrium price, P^*, is lower than what the no-trade equilibrium price was. At this lower price, Region A's consumers demand a higher quantity and their producers want to supply less: this leads to an excess demand of IH. IH is the exact same quantity as AB; the excess demand from Region A exactly equals the excess supply of Region B (point E in the middle panel). Region B exports to A and everyone is happy.

This illustration is over-simplistic for two main reasons. The first is that the cost of moving the lumber from one region to the other was ignored. The second is that this represents the process of discovering a world equilibrium between only two countries. Lets deal with the trade cost first. Figure 31 introduces the concept of transportation/tariff/etc. Costs associated with getting the lumber from Region B to Region A. The cost is represented by the distance wz in the figure, resulting in a increase in the import price, a decrease in the export price, and a reduction in the amount traded (Q^* to Q^{**}). Total transport/etc. costs are equal to the are xywz. This now is a spatial price equilibrium.

From a modelling point of view, it is easy to see how such a two country, one commodity situation might be set up to optimize the ideal spatial trade scenario. Trade is optimized (most efficient) when the area between the excess demand and excess supply curves is at a maximum, net of transportation costs. This area, (1xz + 2yw) is termed the "net social payoff". This concept is difficult to explain without understanding the

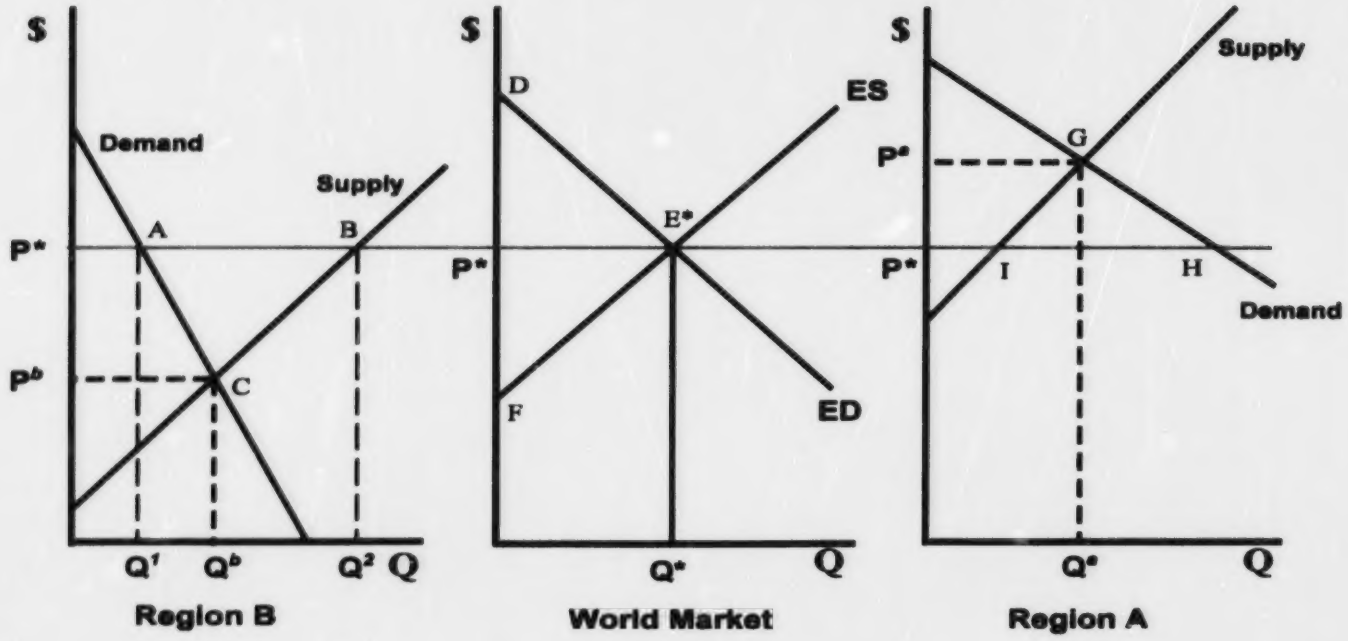

Figure 30 Graphical Representation of a Non-Spatial Trade Equilibrium

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economic concepts of consumer and producer surplus, an explanation of which is not attempted here. A spatial equilibrium trade model does just this. Trade prices and quantities are adjusted until this area is maximized. To deal with the second simplification of this illustration, being that only two regions were involved, a model of this sort can introduce as many regions as desired, summing over all possible trade possibilities the individual net social payoffs, and optimizing. NOTE: this optimization process is analogous to minimizing transportation costs.

The required inputs for such a modelling effort are the functional relationships of the supply and demand curves for the product under investigation for each of the regions. This is normally entered by a Y-intercept for each relationship and a slope of the line (assuming a linear function is used). The slope can be thought of as the demand or supply price elasticity, or the expected percent change in the quantity supplied or demanded given a unit percent change in price (i.e., the price responsiveness of supply and demand). As an alternative to having the Y-intercept (unobservable in actual trade), the equilibrium price for each region (which is observable) can be used along with the slope to calculate the Y-intercept. Finally, actual trade quantities and prices (both FOB from the exporting regions and CIF for the importing regions) are needed to see how well the model "predicts" reality, and calibrate the model for inconsistencies.

Elaborate trade models of this nature exist which not only "predict" trade flows, but internally estimate the needed supply and demand parameters. Understandably, these models can get very complex, requiring extensive time series data among all regions modelled to regress quantity against price and other explanatory variables in the estimation of these parameters. Not surprisingly, this complexity tends to motivate the researcher to use aggregated product groups where data is readily available, such as softwood lumber as opposed to western red cedar lumber. This is unfortunate, as trade models assume that the product under investigation are perfectly homogeneous. In the case of using softwood lumber in aggregate, this is saying that Radiata pine lumber from New Zealand, for example, is a perfect substitute in a buyer's mind for old growth yellow cedar from the British Columbia coast. This is obviously not a very realistic assumption. Further, statistical estimation of such supply and demand parameters, using time series that may span 30 years, is questionable at a time when an industry may be going through structural changes such as the wood products industry appears to be going through now, suggesting that the history of price responsiveness may not be a good indicator of future price responsiveness.

To find a practical compromise, the trade modelling approach devised in the present project is to utilize published and "best guesses" for the supply and demand parameters and to do a sensitivity analysis on the values. This simplifies the complexity of the model dramatically, and allows for a focus on greater product detail, segregating "softwood lumber", for example, into sub-categories which more accurately compete with one another. In short, this transfers the challenge of estimating supply and demand parameters to putting together a data set of disaggregated lumber products.

There is one other strong assumption that is made with *partial* equilibrium spatial trade models. This is a partial equilibrium in that only a single commodity or product is considered in the optimization process, assuming that all other commodities or products are held constant. For example, aggregated softwood lumber might be optimized, ignoring potential substitution effects from hardwood lumber. There are two ways to correct for this. The first is to incorporate substitution effects to the model, then optimizing the flow of both commodities simultaneously. This would involve another set of parameters, the "cross-price elasticities", being the percent change in the demand for one commodity as a result of a price change in another commodity. The second way to deal with this is to place restrictions in the individual optimizations of commodities or products. Given the complexity of the first method, the latter is employed in the present

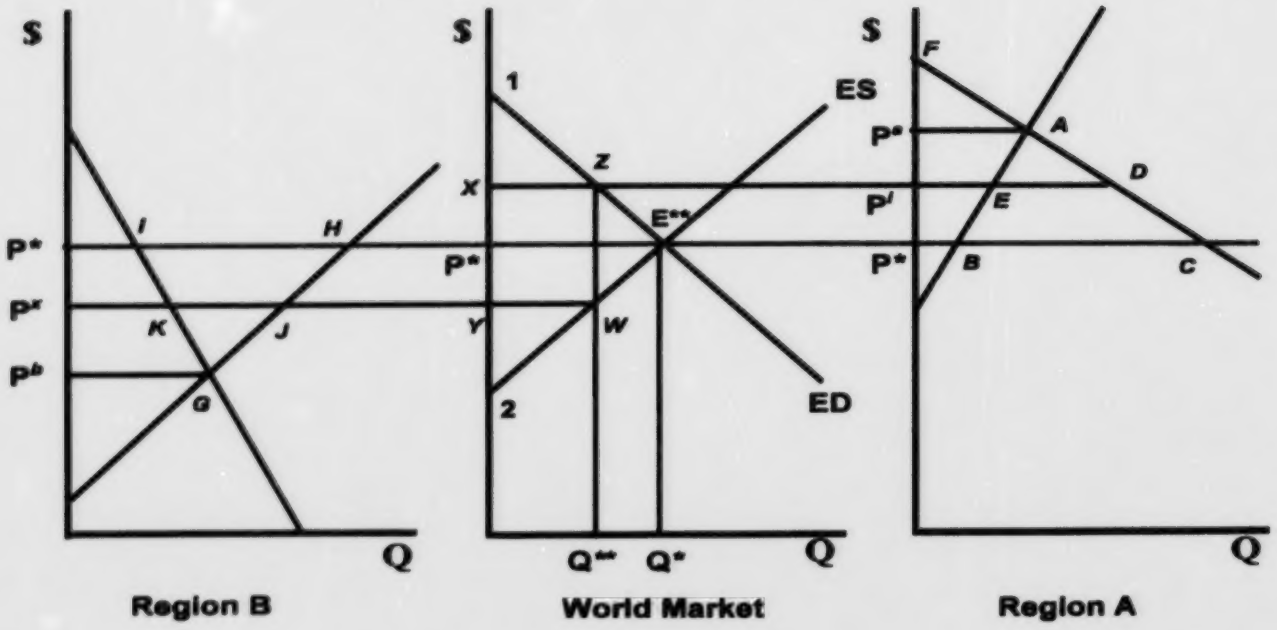

Figure 31 Graphical Representation of a Spatial Trade Equilibrium

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study. Further, as the present study utilizes disaggregated products, the problem of not accounting for substitute products is greatly lessened.

To summarize, the partial spatial equilibrium trade model optimizes trade by estimating quantities traded, world prices and trade flows between regions. Countries with high production costs or supplies that do not meet domestic demand, import product at lower than domestic prices. Countries with lower production costs and supplies that exceed domestic demand export product at higher than domestic prices. These regions continue to trade as long as world prices, net of transportation and other trade costs are higher than domestic prices. To optimize trade (matching of global suppliers with global demanders in the most efficient way), an iterative process is used in the model which maximizes welfare (the objective function) subject to needed constraints. A global equilibrium is reached when the demand price is equal to the sum of the supply price and transportation costs for all regions. Essentially, demanders adjust their mix of suppliers until this equilibrium is reached. Remembering that this is equivalent to maximizing the triangle areas 1xz + 2wy in Figure 31, this optimization problem is represented mathematically for a multi-region case as:

$$\max \sum_i \int_0^{q_i} D_i(q_i)dq - \sum_j \int_0^{y_j} S_j(y_j)dy - \sum_i \sum_j c_{ji} y_{ji}$$

subject to a number of constraints.

In words, maximize the sum of the area under each set of excess demand curves less the sum of the area under the excess supply curves and transportation costs. The implementation of this process is discussed in Section 5.

The benefits of utilizing a partial spatial equilibrium trade model for the present study lie in its ability to deal with an unlimited number of trade regions and products. Furthermore, this modelling technique lends itself to imposing constraints which are unique to softwood lumber trade—for example, the US/Canada Softwood Lumber Agreement, US diversion of logs from Japan to lumber products to their domestic market, or explaining how it is that Scandinavia can compete in Japan.

5 Results and Discussions

5.1 The Trade Flow Data and Reconciliation

It was shown in Section 4 that fairly detailed statistics exist on the production and trade of wood products. While the methodology reported in this project focussed on softwood lumber, data were also collected and categorized for softwood logs, plywood, OSB, particle board, and fibreboard.

As already stated, there are several reasons for documenting these data. First, *trends* in trade are identified. This shows where Canada (and in later breakouts of these data, BC in particular) is and has been positioned relative to competitors, and offers hints to the future. Second, this level of production/trade information allows for trade modelling which moves beyond the common practice of utilizing broad commodity aggregates such as "softwood lumber". Finally the process of reconciling production and trade between regions and subsequent trade modelling offers a vehicle for focussing existing industry knowledge.

From the figures offered in Section 4 and Appendix One, a number of trends can be identified. These include:

Canada

- There has been significant growth in the exports of softwood lumber, led by shipments to the US, then Japan. Other than SPF to the US, however, Japan represents the largest growth in the demand for Canadian lumber (dominated by BC).

- While SPF has by far the largest overall share of softwood lumber exports by volume (to the US), exports of all other species represent roughly 50% by value.

- Japan consistently represents one of the highest unit value export baskets, while the US is among the lowest. This highlights Japan's historical importance as a higher-end product market. (Keep in mind that the unit values shown are FOB—not including transportation to market.)

- Canada exports of further value-added products such as mouldings, flooring, builder's joinery, door and windows are highly significant in terms of export value (exports of mouldings and joinery alone exceeded $1 billon in 1996), and trending higher. The US has historically been the most important market for such products, with exports to Japan increasing.

United States

- US exports of softwood lumber in aggregate is declining dramatically. By species, SPF export volumes, while small overall, increased over the past decade, and hem-fir and sitka spruce exports increased to a peak in 1994, then declining ever since. The export of all other species have been either stable or in sharp decline throughout the 1990s.
- With most species of softwood lumber exported, unit values showed a strong premium for Japan over other markets, particularly in the past few years.

- The US has also seen significant increases in the export of further value-added products.

- Illustrated by the Canada export numbers to the US, their imports of most wood products is increasing (their trade deficit in wood products growing). While the US imports of value-added products such as mouldings and flooring is also increasing markedly, they continue to have a trade deficit in such products as well.

Japan

- While overall imports of all solid wood products (including logs and panels) has been fairly stable over the 1990s, softwood lumber imports remains on an up-trend, led by Canadian product.

- SPF and "other planed" lumber continue to dominate imports in volume terms. "Other planed" is an annoying catch-all category used by the Japan Tariff Association which includes all non-SPF, non-rough lumber imports (fortunately, this category is to be broken down into greater detail from 1997 onward). From Canada, this category will largely be surfaced hem-fir. (Note: in all of the Japan lumber import figures shown, species other than SPF or "other planed" refer to rough lumber. Also, what the Japan

Tariff Association is calling Hemlock is really rough hem-fir.)

- Lumber size breakdown volumes in the figures indicate a smaller proportion of large dimension in most species of rough lumber.

- Unit values throughout the 1990s showed strong nominal increases in virtually all species of lumber. **Note**, however, that the unit values were expressed in Canadian dollars. When viewed in Japanese Yen, which has gained strength against the Canadian dollar over the past 3 decades (with the exception of the past 18 months), prices have *declined* in real terms from the Japanese buyers' perspective.

- Continuing in the overall trend by the Japanese to substitute commodity imports with more processed products, exponential increases in the imports of value-added products are being witnessed. This includes laminated lumber (structural laminated lumber in the figures is glulam), doors, windows, mouldings, joinery, furniture, and even manufactured homes. In the case of total laminated lumber, Canada has not been a significant supplier while the US remains a major player. The real growth, however, has been from Scandinavia (structural) and the South Seas (non-structural). Interestingly, the 1996 growth in the market share for Scandinavia glulam has coincided with a dramatic drop in the unit value. Note as well that the Japanese domestic production of glulam is also increasingly exponentially (See Appendix One).

- Domestic production of solid wood products continues to be an important supply for Japanese demand. While Japan has evolved from virtual self-sufficiency in the 1960s to a heavy reliance on imports since, their domestic production could be expected to increase as their post-war plantations mature and incentive to further invest in their resource escalates with decreases in the value of their currency.

As an input for the subsequent trade modelling efforts, Section 4 outlined how these data were categorized into 4 "like" baskets on the basis of price, loosely representing appearance grade lumber, Japan construction grade lumber, US construction grade lumber, and utility/econo grade lumber. Simultaneously, these date were reconciled, that is insuring that the volumes reported by an exporter agree with the corresponding volumes imported by the importers.

Table 4 offers an example of the results of this process, showing the trade flows and reconciliation for the "big three", being Canada, the US and Japan.

5.2 Spatial Equilibrium Trade Modelling

Section 4.2 briefly summarized the process of trade modelling. While straightforward in theory, it can be very complex to implement. To begin with, estimates of domestic supply and demand relationships are required for each of the regions identified in global trade, including a miscellaneous "rest of world" region. In a modelling sense, these relationships must be entered as equations which characterize the level of supply and demand (graphically, the position of the supply and demand curves), and how producers and buyers react to price changes in the quantity amount they are willing to sell or buy (the slope or shape of the supply and demand curves). It is this very process, *econometrically* estimating the parameters that make up the functional relationship between price and quantity demanded or supplied, that make existing trade models so complex. These are, after all, very complex relationships. They involve modelling human behaviour,

Table 4 Softwood Lumber Trade: Canada/US/Japan

Canada to Japan (FOB / CIF)

#1		#2		#3		#4		**Total**	
m3	$US/m3	m3	$US/m3	m3	$US/m3	m3	$US/m3	**m3**	**$US/m3**
1,223,038	340	3,151,745	218	558	110	0		4,375,341	252
1,223,039	383	3,152,031	242	0		0		**4,375,070**	**281**

Canada to US (FOB / CIF)

#1		#2		#3		#4		**Total**	
m3	$US/m3	m3	$US/m3	m3	$US/m3	m3	$US/m3	**m3**	**$US/m3**
8,311	260	1,787,157	186	29,059,670	109	0		30,855,138	113
6,695	283	2,570,655	171	28,278,128	108	0		**30,855,478**	**113**

US to Japan (FOB / CIF)

#1		#2		#3		#4		**Total**	
m3	$US/m3	m3	$US/m3	m3	$US/m3	m3	$US/m3	**m3**	**$US/m3**
620,573	317	1,468,095	201	4,875	107	0		2,093,543	235
620,573	398	1,475,747	248	0		0		**2,096,320**	**292**

isolating a few variables that strive to predict producers' and consumers' actions.

Econometric estimations of this sort typically involve statistical regressions over time, perhaps over several decades. This further complicates the process as human behaviour is not likely to be static. In other words, the relationship between the quantity demanded and price of a product over the past 20 years may not be a good indicator of future behaviour. This can be incorporated into the estimations through more complex mathematical relationships, but remains ineffective if changes in demand, technology, products or suppliers are too dramatic.

To make matters worse, any trade modelling effort requires individual country production and price data as inputs, as well as trade volumes and FOB/CIF prices for verification of the model predictions. This means dealing with a number of independent data source throughout the world, and the often daunting task of reconciling the numbers. While harmonised systems do exist, many countries, including Japan, choose not to adopt them. How can we try to predict trade flow responses to outside "shocks" such as the introduction of a new product, or a dramatic exchange rate fluctuation if we can't even establish what the existing trade is?

With these complexities in mind, it is easy to see why existing efforts by forest economists have focussed on broad commodity aggregates such as softwood lumber as opposed to individual products and/or species.

Supply and demand relationships become easier to quantify and production/trade easier to reconcile. But is the output of such efforts adequate? Can we live with the assumption that softwood lumber in aggregate from Russia, for example, is a perfect substitute in the Japanese market for softwood lumber in aggregate from the BC Coast? This all depends on the questions that the researcher wants answers to. For example, this is clearly *not* acceptable if we want to know what the likely effect of the trade flow of hem-fir from the BC Coast from increased competition from Scandinavian whitewood in the Japan marketplace.

The trade modelling component of this project had two objectives. The first was to record wood product flow information with as much product detail as possible. The second was to offer a method of incorporating greater trade detail than that prevalent in the literature.

It was shown that while the data are not without their problems, existing trade detail offers a good starting point in moving past broad commodity aggregates. Softwood lumber statistics are available by species, rough versus surfaced, often size, and a breakout of further processed lumber products/substitutes such as glulam, non-structural laminated lumber, doors, windows, joinery, flooring, siding, mouldings, manufactured homes, etc. Gathering this information completed the first objective.

The second objective yielded the first iteration of a trade model, using the regions and products shown in Table 5.

Rather than estimating the supply and demand parameters for the product in each of the identified regions (as discussed above), published and/or "best guesses" were utilized, with the eventual goal of performing sensitivity analysis around their values. This offered a starting point for refinement with the help of the steering committee and others, creating a mechanism for collecting existing knowledge and expertise.

Initially, the trade model utilized softwood lumber in aggregate. This was done to compare to the second result, utilizing four "categories" of softwood lumber. For this first effort to separate non-competing products (such as utility vs. structural vs. appearance lumber), these categories were defined by the markets' willingness to pay, or price. Each category of softwood lumber was then trade-optimized individually.

Table 5 Region and Product Detail Employed in the Trade Model

Supply Regions:	BC	*Products:*	Aggregated Softwood Lumber
	Rest of Canada		
	US		VS
	Scandinavia		
	New Zealand		Softwood Lumber #1
	Chile		Softwood Lumber #2
	Japan		Softwood Lumber #3
	Rest of World		Softwood Lumber #4
Demand Regions:	US		
	Japan		
	Western Europe		

5.2.1 Spatial Equilibrium Trade Model Base Case and Simulations

The trade model presented in this study is a spatial equilibrium model that estimates quantities traded, international prices and trade flows among regions. Under the assumptions of the spatial equilibrium model, regions with high costs of production or inadequate supplies will look to world markets to satisfy domestic demand at lower prices. Likewise, regions will supply world markets if they can obtain prices that exceed domestic prices. Regions will continue to trade as long as prices, net of transportation and other transfer costs, differ from domestic prices. Through an iterative process which minimizes world-wide transport costs, a spatial price equilibrium is established when the demand price is equal to the sum of the supply price and transportation costs for all regions. Consumers continue to rearrange their consumption bundle in favour of cheaper suppliers until this equilibrium is reached.

A spatial equilibrium model is used so bilateral trade flows can be observed. As more countries enter the world market, interactions become more complex and optimal trade flows become less obvious for each region. The model assumes cost minimizing (profit maximizing) behaviour by the consumer (producer). Enke (1951) summarizes the one commodity model as follows:

> "There are three [or more] regions trading a homogeneous good. Each region constitutes a single and distinct market. The regions of each possible pair of regions are separated but not isolated by a transportation cost per physical unit, which is independent of volume. There are no legal restrictions to limit the actions of profit-seeking traders in each region. For each region the functions which relate local price are known, and consequently the magnitude of the difference which will be exported or imported at each local price is also known. Given these trade functions and transportation costs, we wish to ascertain:
>
> 1) the net price in each region,
> 2) the quantity of exports or imports for each region,
> 3) which regions export, import, or do neither,
> 4) the aggregate trade in the commodity, [and]
> 5) the volume and direction of trade between each possible pair of regions."

This project uses a spatial equilibrium model to look at global softwood lumber trade flows. Softwood lumber production, consumption, price and trade data are disaggregated into three different product categories and simulations are performed in an attempt to understand how changes in economic, social and industrial conditions can affect softwood lumber trade. The reason that only three price categories were modelled is that softwood lumber #4 (the utility grade) showed no trade due to the trade by species data set (i.e., the utility grade will be incorporated into softwood lumber #3). More will be said about this in Section 6.

Due to the assumptions and nature of the spatial equilibrium model, bilateral trade flows estimated by the model will not always mimic real world conditions. Rather, the model solves for the matrix of trade which generates the greatest wealth among all participants.

5.2.1.1 General Assumptions

The assumptions of the spatial equilibrium model require further attention. The model assumes a perfectly competitive market where world consumption is equal to world production at any time period. Homogeneous goods, per unit transportation costs and free trade are simple rules that form the benchmark of the "normal"

competitive model. Some problems arise, however, when this model is applied to real market conditions and additional assumptions are often needed to create more representative conditions.

Homogeneity

The spatial equilibrium model assumes that each commodity is viewed as a homogeneous good by the consumer. This implies that all lumber within a particular category is of the same quality and available to all consumers at a single price, differing only by the transport cost between the importer and the exporter. Obviously, this is an unrealistic assumption as there are often large differences in prices of lumber depending on the grade, size of lumber, method of processing and the species of log. As well, consumers in one region may place a higher valuation on the product than consumers in another region, implying that the product is not a homogeneous one but rather a bundle of many different products.

This assumption was the impetus for the disaggregation of total softwood lumber into 3 distinct price categories. Even with this breakdown, there is still a wide range of quality and prices within each softwood lumber category. Larger logs require less handling per cubic metre of output, produce more output per cubic metre and usually possess the desired characteristics of performance grade lumber (and therefore return higher profits). Some of these differences are captured in regional supply equations. As discussed above, quality differences arise across species as well as within species. Dealing with a commodity such as lumber is a difficult task when creating a forest model. Unlike pulp and paper, thousands of different products and qualities comprise the sawtimber commodity. Most models assume that softwood lumber is a homogeneous product that is perfectly substitutable with sawtimber from other regions and among species. The current model provides superior analysis by providing the further breakdown of softwood lumber, however the variation within each product category is still problematic.

Competitive Market Assumption

In determining a spatial equilibrium, it is assumed that a competitive market exists across all regions. Although this is not always the case in the real world, the model assumes that neoclassical long-run conditions hold so that economic profits equal zero (i.e., normal profits prevail), supply equals demand and average total cost equals price. The spatial equilibrium model maximizes an objective function to yield an efficient allocation of goods within given constraints. A firm chooses efficient allocations where profits are maximized for a given price. The model used in this study assumes competitive equilibrium and has the ability to account for exogenous circumstances that are not already endogenous to the model.

Preferences

The wide range of quality in lumber products makes it difficult to model changes in tastes. Consumption of high quality lumber may remain inflated even when lower quality lumber is available at a lower price. Flora, Anderson and McGuiness (1991) found that offshore demand was more willing to absorb price increases in performance grade logs compared to construction grade logs. This indicates that higher quality grades are more resilient to changes in prices and more likely to show inertia in trade. This phenomenon would suggest that Canadian softwood lumber should continue to experience high demand even at higher prices. However, since tastes are driven in part by price, over time as tastes change (maybe consumers begin to have a preference for cheaper wood simply because it is cheaper), lower priced goods will substitute high priced goods. This price-quality interaction between categories is not included in the current version of the trade model, however it will be included in subsequent versions.

Trade Inertia

It is assumed that a trading agent will maximize profit by choosing the lowest cost and, therefore, the most

profitable trade route available. This is not always the case due to trade inertia. Trade inertia is the extent to which historical patterns of trade prevail over time. Once one country has established a trading relationship with another, it is more likely to continue to trade with that country than to spend resources in developing other trade relationships. Many factors influence a nation to carry on a trading relationship even when relative price and cost differentials indicate otherwise. Trade between regions has been driven by numerous factors including culture, geographic location, political structure and accessibility. Other factors include availability of information, preferences, costs of changing to other markets and long-term contracts. Prohibitive trade barriers also affect the inertia of trade as do tariffs, non-tariff barriers, embargoes, cartels and lack of information. As international trade becomes more efficient, inertia will play a less dominant role. For commodity goods, inertia is less of a concern than with products that are easily differentiated.

Other Assumptions

Since the SE model is unable to predict bi-directional trade flows, it is necessary to make assumptions regarding the production and consumption characteristics of some regions. It is believed that valuable results can be obtained for regions that are both importers and exporters. The reason why a region imports lumber even though it already has an excess supply is producer specific and could be a function of quality, short-term inventory deficits or location. Since these factors cannot be modelled in a spatial equilibrium model, the current models divides the US into an export and an import region. The creation of these two regions enables inter-state trade to be analysed.

5.2.1.2 The Model

Each region is assumed to be a net importer, a net exporter or neither, depending on the domestic equilibrium price. The trade functions are generated from each region's 1992 domestic price and quantity data and then estimating their respective excess demand or excess supply curves. Basically, if a region is a net exporter, it has excess supply that can be sold on the world market at a price equal to or greater than the domestic price. If a region is a net imported, its domestic production cannot satisfy domestic demand at current prices and therefore consumers must purchase from the world market. Changes in domestic conditions are measured in the international market through changes in the market-clearing price in each region. International trade conditions are dependent on domestic conditions and the relative size of the domestic markets. It is obvious that supply changes in Canada will have a more dramatic effect on price than a small volume exporter such as Chile.

Willingness to Pay

The willingness to pay by consumers and the willingness to supply by producers (referred to as elasticities in economic literature) plays an integral role in calibrating the model to replicate real world conditions. These variables coupled with price, quantity and transportation data dictate how the trade functions interact in a global context. The current model uses estimates from the economic literature, coupled by the opinion of the authors and industry to form a basis for the supply and demand elasticities. A sensitivity analysis of these assumptions will be performed in further iterations of the model.

Constraints

Constraints are used to place upper and lower bounds on trade flows between regions. Although it is optimal to use as few constraints as possible and let the solving process of the model predict trade flows, it is often necessary to impose trade flow restrictions between some region as well as force trade between other regions. This does not yield a true competitive equilibrium, however it does replicate real world conditions more closely. Actual trade seldom adheres to the perfectly competitive outcome due to tariff and non-tariff

barriers, differing product qualities and long-term contracts. Over time, however, equilibrium conditions are expected to prevail.

When the model becomes dynamic (i.e., it is calibrated over a multi-year period) and is used for projecting future market scenarios, constraints that relate production costs to entry and exit points will be used. This allows the analysis of the relative cost structures of different regions and how production is affected by price changes.

Transportation Costs

Transportation costs, used to quantify the relative distances between trading partners, play an important role in determining flows and direction of trade. Transport costs of commodities with low value-to-weight ratios, such as lumber, are even more important, especially when looking at a region's ability to compete with distant markets. Canada's close proximity to the giant US market gives Canadian forest companies a geographic advantage over competing foreign producers. Foreign marginal producers cannot afford to trade due to their proximity to importing regions and therefore must compete on another variable other than price.

Transportation costs can be difficult to estimate due to highly variable freight rates. Costs vary between regions and over different distances, particularly with respect to port handling fees. Long-term contracts, energy costs, port facilities, backhaul availability, commodity and length of haul are all determinants of shipping costs and account for the highly unstable transport costs. In spatial equilibrium models, transport costs are assumed to be independent of volume and a function only of distance. The model calibrates by assuming that the transportation cost is equal to the difference between a region's average F.O.B. price and the average C.I.F. price of the importer. This is not a trivial assumption since there are factors other than freight and insurance imbedded in the average prices. A strategy used by Cardellichio *et al.* (1989) is adopted and used to model transportation and other transfer costs in this study. The price equilibrium is defined as follows:

$$Pi = Pj + Tji + Cji,$$

where :
P is the average product price,
T is the transportation cost,
C is the value adjustment or quality differential, and
i and j are the importing region and exporting regions, respectively.

The difference in price between regions, the apparent transportation cost, $Tji + Cji$, is referred to as the transfer costs. Cji can be either positive or negative, depending on tariff and non-tariff barriers as well as the average quality of the lumber shipped compared to the average quality of the domestic market supply. Tariff rates on softwood lumber vary from region to region and, in the model, are included in the Cji term. Adjustments cost less than zero simply implies that the average value of the export is greater than the average value of lumber produced in the importing region. This does not affect the solution procedure.

The importance of C_{ji} should be stressed since its value holds important information regarding trade between regions. For example, the apparent transportation cost between Canada and Japan for softwood lumber #1 (SWL1) is US$71/m3 whereas the transportation costs between Scandinavia and Japan is only US$52/m3. These values are made up of actual transport costs, Tji, as well as a *value adjustment*, Cji. The value of Cji

is imbedded with a number of market and non-market factors that affect the value of apparent transportation costs.

5.2.1.3 Validation

In order to evaluate the model's usefulness as a policy tool, it must be tested to see if it simulates actual market conditions. There are a number of methods of validation. First the model should be validated through simulation. For this report 1992 will be deemed the base case and will be used as a benchmark to look at future scenarios. The model is calibrated to equal the production, consumption and trade in 1992 and from these data, future market conditions can be simulated. The model's ability to accurately project future trade flows is an excellent indicator of the model's capabilities of evaluating future economic conditions. Since short-term market fluctuations can cause projected values to diverge from actual values, short-term projections must be used with caution. Performing historical simulations is not advised since the structural changes within the industry are not endogenous to the model and the model is unable to account for these developments. Furthermore, the model is calibrated using cost assumptions and consumer preferences of 1992. Table 6 displays the optimized trade flows of aggregate softwood lumber in 1992 along with actual trade. The base case results are generated from summing the simulated trade from the base case of SWL1, SWL2 and SWL3.

Another method of model validation is to compare the model results to expectations of industry, government and academia. Since it is the goal of the programmer to develop a model that replicates past, current and

Table 6 Direction of Trade (000s cubic metres)

All Softwood Lumber Actual					
Export/Import	US East	Japan	Europe	ROW Importer	Total Exports
Canada	30,855	4,375	2,543	1,578	39,351
US West	14,051	2,093	902	3,240	20,286
Scandinavia	0	2	10,690	2,626	13,316
New Zealand	24	248	3	636	911
Chile	85	256	171	287	799
Baltics	0	0	3,552	425	3,977
Russia	0	225	2,414	3,546	5,960
ROW	161	214	865	1,402	2,642
Total Imports	45,176	7,413	21,140	13,740	87,242
All Softwood Lumber Base Case					
Export/Import	US East	Japan	Europe	ROW Importer	Total Exports
Canada	30,675	4,917	3,292	1,120	40,004
US West	14,222	1,674	1,136	3,136	20,168
Scandinavia	5	30	13,103	51	13,189
New Zealand	495	409	0	0	904
Chile	292	44	108	347	792
Baltics	0	2	1,930	2,048	3,980
Russia	0	786	1,145	4,002	5,933
ROW	155	432	66	1,189	1,843
Total Imports	45,846	8,294	20,781	11,891	86,813

future trade flows, the model should be in agreement with the expectations of future conditions. When further scenarios and projections are competed, the results will be compared to results from other sources. A final method of model validation is to evaluate how the model responds to policy changes. The basic test is to see whether trade flows, prices and quantities move in the expected direction when a shock is applied to the model. For example, supply increases in the US South should cause a decrease in Canadian exports to this region. Further tests include comparing absolute and relative values of simulation results with actual, projected and intuitively reasonable results. The scenario reported below provides intuitive results when compared to the benchmark of the base case.

5.2.1.4 The Model Results

This paper reports the results of the 1992 base case and a simulation that looks at how production, consumption and trade change under a scenario of decreased Japanese demand for all softwood lumber products. By analysing how different scenarios cause trade to diverge from the base case, insight can be gained regarding the long-term behaviour of global lumber trade. The results may be interpreted and used to aid in policy decisions for industry development. The base case is developed from 1992 equilibrium conditions from which assumptions are made about current market conditions. In order to calibrate the model, some constraints were imposed on 1992 trade flows.

5.2.1.5 Data Assumptions

To model the US both as an importer and an exporter it was necessary to separate it into two regions. Most imports into the US are destined to the newly crowned dominant production region, the East. The model assumes that exports to the US are shipped to the eastern market. Shipments into this region from the US West are assumed to be imports by the trade model. In 1992 shipments from the West to the East totalled over 14.0 million cubic metres for all categories of softwood lumber. Of the 6.2 million m3 exported from the US, marginal quantities came from the East. For the purposes of modeling trade, these volumes are tallied as exports from the US West.

Since production data cannot be broken down by grade or species, determining the volume of production for each price category is impossible without making a number of assumptions. Relative trade volumes for each category provide an excellent starting point for the mix of production in a region. For the purpose of the model, the percent of trade volumes for each category is assumed for production. Canada and the US are the exceptions to this assumption. A higher proportion of SWL1 production is assumed to enter world markets from these regions and therefore domestic consumption of this product was decreased by 20 percent.

At the time of the simulation run, trade data for the European countries were unavailable in the detail needed for this project and a number of assumptions were used. First, net imports were used for this region to reduce the possibility of double counting trade volumes. This assumes that all exports from the 12 EU countries stay within the region. Next, the average price of all categories was used to determine a breakdown of volumes for each price category. The sum of the three trade categories equals total trade into the region.

5.2.1.6 The Base Case

The results of the base case simulation are used as a benchmark when assessing different demand and supply shocks to the softwood lumber market. It should be stated again that although the model calibrates to actual production, consumption and total trade, projected trade flows and actual trade flows may differ substantially.

This should not come as a surprise since the model is solving for a solution where all regions are operating in a perfectly competitive environment with perfectly competitive expectations. Differences in simulated and actual trade flows are due to, among other factors, heterogeneous products, trade barriers and trade inertia between regions. Table 7 details the simulated direction of trade for SWL1.

Table 7 Simulated Direction of Trade (000s of cubic metres)

Base Case – Softwood Lumber 1					
Export/Import	US East	Japan	Europe	ROW Importer	Total Exports
Canada	44.8	1,373.0	162.3	279.9	1,859.9
US West	798.6	512.1	480.4	828.7	2,619.8
Scandinavia	2.6		2,985.9	10.3	2,998.7
New Zealand	222.9				222.9
Chile	40.8	44.0			84.8
Baltics			106.7	184.0	290.7
Russia					
ROW	53.5	129.8	66.1		249.5
Total Imports	1,163.3	2,058.9	3,801.3	1,302.8	8,326.4

5.2.1.7 A Decline in Japanese Demand

The model was used to simulate a shock to the demand for softwood lumber. Each region, except for Japan, was assumed to experience a 5 percent increase in the demand for softwood lumber; Japan's demand was curtailed by 5 percent, representing a 10 percent change in Japanese demand compared to the other regions. The interesting thing about the trade model is how it accounts for the complex interaction of trade flows between regions. The model calibrates by minimizing the freight costs between all regions, thereby maximizing the value of softwood lumber traded.

Under the proposed simulation, intuition suggests that Japanese consumption will fall. Furthermore, since consumption consists of imports and domestic production, these two sources of softwood lumber should also decline. The value of the trade model can now be realized in its ability to assess the magnitude of the reduction as well as the effect of the reduced demand on the other trading regions. Table 8 and 9 show that in the case of SWL1, Japan's drop in demand causes a drop in the exports of Chile, the Baltic States as well as the ROW exporters. This is interesting, especially in the case of the Baltic States, which had no trade relations with Japan. The chain of events that happened saw the US having to divert exports away from Japan into the European marketplace. The entrance of high quality US SWL1 forced the Scandinavians to find a new home for some of their exports in the ROW import market. This forced the Baltic States out of this market and caused them to experience a decrease in exports. Now remember, in all regions it was simulated that there was a 5 percent increase in demand for SWL1 (as well as SWL2 and SWL3). In the case of the Baltic States, Chile and the ROW exporters, this increase in domestic demand caused consumption to increase greater than the increase in production. The increased demand forced these regions to decrease their exports in favor of supplying their domestic economy. Figure 32 illustrates the effects of the simulated change in demand for SWL1.

Table 8 Decline in Japanese Demand: Change in Production, Consumption & Trade
(000s of cubic metres)

Softwood Lumber 1							
	Change in				Change in		
Export Regions	Prod.	Cons.	Trade	**Import Regions**	Prod.	Cons.	Trade
Canada	88.06	23.75	64.30	US East	11.23	84.55	73.33
US West	181.64	118.82	62.82	Japan	130.33	-534.50	-664.83
Scandinavia	102.49	72.89	29.60	Europe	68.54	373.03	304.49
New Zealand	4.67	1.47	3.20	ROW Importer	131.87	447.81	315.95
Chile	7.89	20.33	-12.44	**Total**	**341.96**	**370.89**	**28.94**
Baltics	17.00	66.61	-49.61				
Russia	0.00	0.00	0.00				
ROW	27.03	95.97	-68.94				
Total	**428.77**	**399.83**	**28.94**				

Table 9 Decline in Japanese Demand: Direction of Trade (000s of cubic metres)

Softwood Lumber 1				
Export/Import	US East	Japan	Europe	ROW Importer
Canada	325	1,394	76	129
US West	578		2,104	
Scandinavia	1		1,538	1,489
New Zealand	222		5	
Chile	72			
Baltics			241	
Russia				
ROW	39		142	
Total Imports	1,237	1,394	4,106	1,619

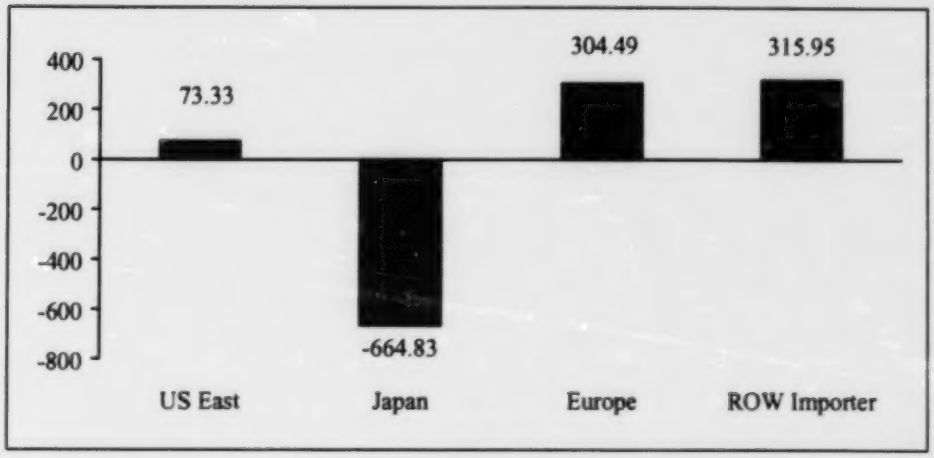


Figure 32 Decline in Japanese Demand: Change in Trade, SWL1
(000s of cubic metres)

6 Conclusions

6.1 The Trade Flow Data and Reconciliation

The underlying objective of the trade flow data compilation, subsequent categorization into end-use categories and ultimate reconciliation was to create "baskets" of softwood lumber which could be trade optimized. In order for the trade modelling efforts to be meaningful, these baskets had to represent as homogenous of a softwood lumber product as possible with existing trade information.

In this study, this was accomplished on the basis of price categories, or specifiers willingness to pay for the product relative to the cost of its production. These price categories were applied to softwood lumber by species, sometimes degree of processing and sometimes by size breakdown, but not by grade (as the latter is not available). While the results represent an important first step in moving away from softwood lumber in aggregate (i.e., having only one "basket"), it is still far from perfect.

Referring back to Table 4, it can be noted that the average unit price of softwood lumber #1 (the "appearance grade") going to Japan, for example, is US $340 per m^3 FOB Canada and US $317 FOB the United States. Further, the average price of this category going from Canada to the United States is US $ 260. When these data are used in the trade model, it is assumed that they are all perfectly substitutable for one another, yet there is a range in FOB prices that span US $ 80. Obviously they are not perfect substitutes.

This problem is not as acute for softwood lumber category #2 (the Japan construction grade), at least not in the Canada versus US shipments to Japan. But this category also has a fairly wide price spread when one

introduces Canada shipments to the US. Softwood lumber category #3 (the US construction grade), on the other hand, is very consistent. Finally, it can be noted that softwood lumber category #4 (the utility grade) is non-existent in the available trade data.

These observations suggest that the price categories that were used in the first iteration of the data organization and subsequent trade modelling need to be fine tuned. First, it is apparent from the results that it is not possible to filter out a utility grade. Given that the data are species aggregates for the most part, this is not too surprising. Second, while relatively price variations in unit prices were found to be relatively small for softwood lumber #2, too large of a variation exists on softwood lumber #1 to consider this a basket of "like" product.

As a result of what has been learned from the first iteration of the data categorization, further analysis of softwood lumber will involve three changes. First, the utility grade category is going to be dropped. Second, there will be an addition of a second "appearance grade" category. Finally, the price groupings created will be fine tuned. The result of these changes will be reported in *Competitor Analysis Two*, along with the data categorization and reconciliation of logs and panel products.

6.2 Spatial Equilibrium Trade Modelling

Using a simulated trade model provides researchers, industry and policy makers with a base case of the most likely outcome given current knowledge of the economy and industry. The trade model is to be used as a tool in the decision making process. By itself, it should not be used as a "crystal ball" in predicting future trade relationships nor as a forecasting tool in making production and investment decisions. Rather, the value of the trade model lies in its ability to provide a starting point that is indicative of current industry knowledge and a best guess of how the future could unfold. From this base case, a number of assumptions and possible future scenarios (i.e., shocks to the economy in general and the forest industry in particular) can be simulated to see how future trade could evolve. The model, as it is currently reported, is a static representation of the base year 1992 for each softwood lumber product with no interaction between each other and other products. From the results of the 1992 base case, the validation process was performed.

The results from the simulation run outlined above are very encouraging in the validation process. Not only is the model "behaving" in an intuitively rational manner, the results are coming close to replicating real world conditions with minimal constraints imposed. Separating softwood lumber into four distinct products provided superior results compared to the assumption that softwood lumber is a homogeneous product. When data from subsequent years are used to mimic trade flows from 1993 to 1997, further fine-tuning of model can be made. This may involve imposing inertia constraints that acknowledge the "stickiness" of trade between established trade regions as well as developing a further breakdown of Softwood Lumber #1 (SWL1).

The results of the simulated decline in Japanese domestic demand reported a substantial decline in Japanese imports of SWL1. Economic theory and the trade model suggest that the decline in imports would be greater than the decline in domestic consumption. As demand declines in Japan but increases elsewhere, there is pressure on prices to rise. This allows domestic producers in Japan to increase their production to supply a greater share of the domestic market.

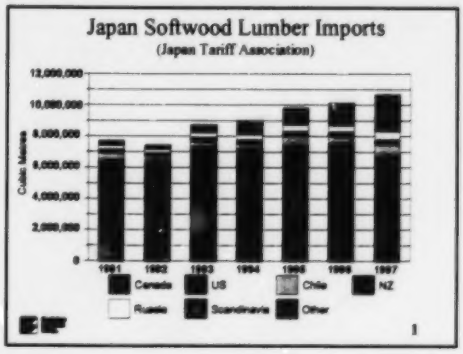
Linking log volumes to lumber production is the next stage of the modeling process. This addition will allow the user of the model the ability to make assumptions regarding the underlying log supply for the softwood lumber industry. A variety of scenarios that could be tested include a reduction of international log trade, the restriction of harvesting rights and the substitutability of pulp logs for sawlogs. This is especially useful in the evaluation of the newly emerging regions such as Chile and New Zealand where log exports are commonplace.

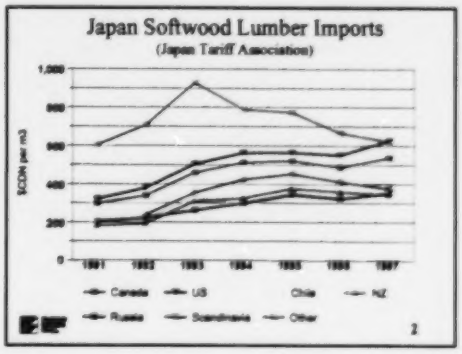
Appendix One

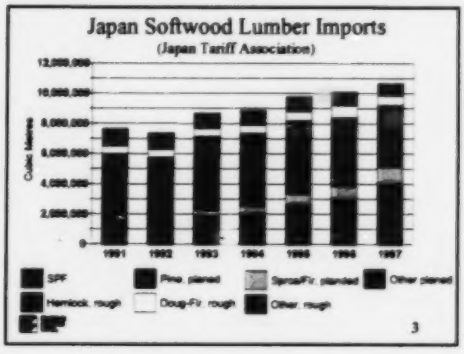
Trade-Flow Quantity and Unit Value Charts

for

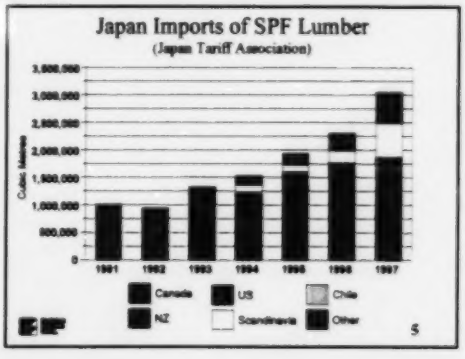
Softwood Lumber

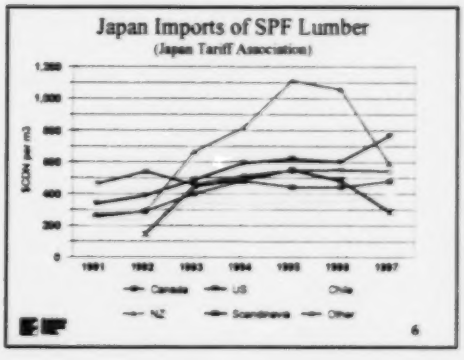

Japan Softwood Lumber Imports
(Japan Tariff Association)
Cubic Metres
Canada
US
Chile
NZ
Russia
Scandinavia
Other
1

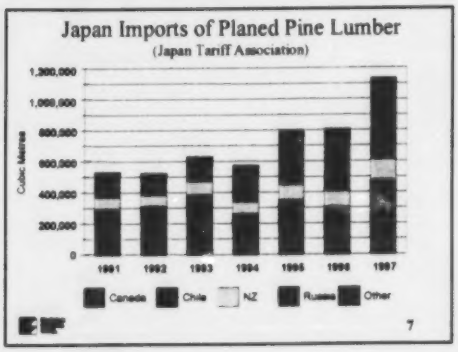

Japan Softwood Lumber Imports
(Japan Tariff Association)
$CDN per m3
Canada
US
Chile
NZ
Russia
Scandinavia
Other
2

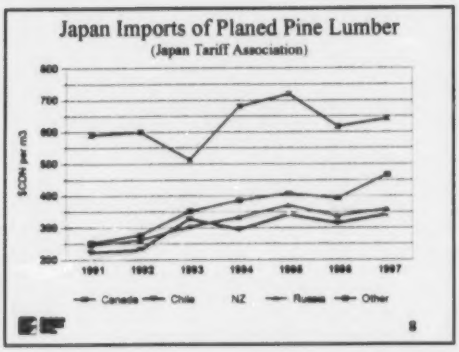

Japan Softwood Lumber Imports
(Japan Tariff Association)
Cubic Metres
SPF
Pine, planed
Spruce/Fir, planed
Other planed
Hemlock, rough
Doug-Fir, rough
Other, rough
3

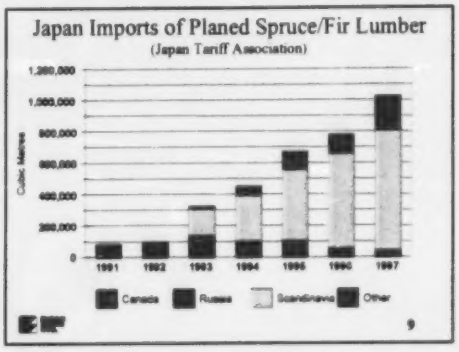
Japan Softwood Lumber Imports
(Japan Tariff Association)
$CDN per m3
SPF
Pine, planed
Spruce/Fir, planed
Other planed
Hemlock, rough
Doug-Fir, rough
Other, rough
4

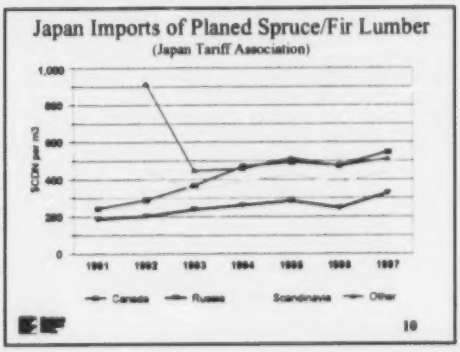

Japan Imports of SPF Lumber
(Japan Tariff Association)
Cubic Metres
Canada
US
Chile
NZ
Scandinavia
Other
5

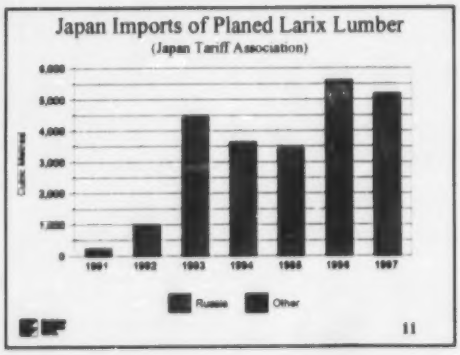

Japan Imports of SPF Lumber
(Japan Tariff Association)
$CDN per m3
Canada
US
Chile
NZ
Scandinavia
Other
6

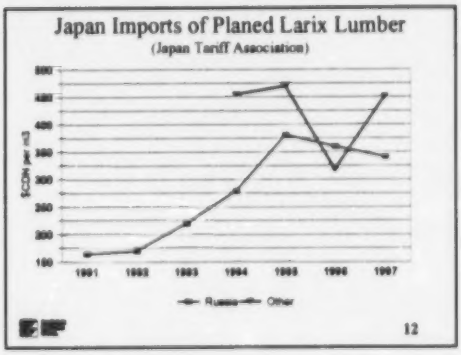

Japan Imports of Planed Pine Lumber
(Japan Tariff Association)
Cubic Metres
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1991 1992 1993 1994 1995 1996 1997
Canada Chile NZ Russia Other
7

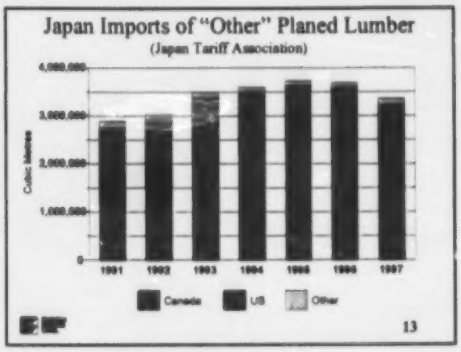

Japan Imports of Planed Pine Lumber
(Japan Tariff Association)
$CDN per m3
800
700
600
500
400
300
200
1991 1992 1993 1994 1995 1996 1997
Canada Chile NZ Russia Other
8

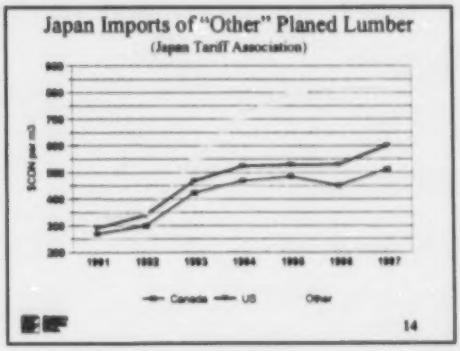

Japan Imports of Planed Spruce/Fir Lumber
(Japan Tariff Association)
Cubic Metres
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
1991 1992 1993 1994 1995 1996 1997
Canada Russia Scandinavia Other
9

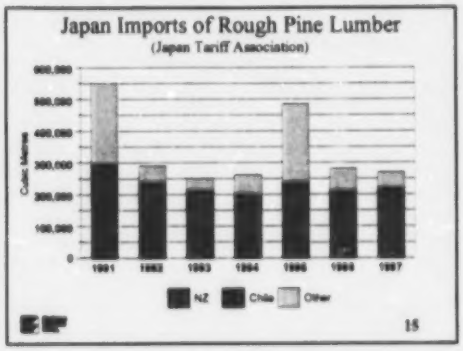

Japan Imports of Planed Spruce/Fir Lumber
(Japan Tariff Association)
$CDN per m3
1,000
800
600
400
200
0
1991 1992 1993 1994 1995 1996 1997
Canada Russia Scandinavia Other
10

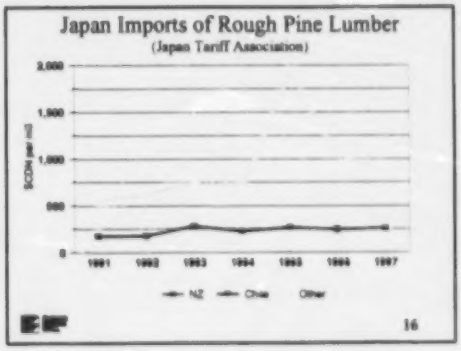

Japan Imports of Planed Larix Lumber
(Japan Tariff Association)
Cubic Metres
6,000
5,000
4,000
3,000
2,000
1,000
0
1991 1992 1993 1994 1995 1996 1997
Russia Other
11

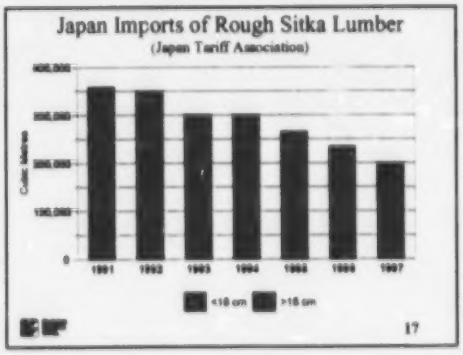

Japan Imports of Planed Larix Lumber
(Japan Tariff Association)
$CDN per m3
500
450
400
350
300
250
200
150
1991 1992 1993 1994 1995 1996 1997
Russia Other
12


Japan Imports of "Other" Planed Lumber
(Japan Tariff Association)
Cubic Metres
Canada
US
Other
13


Japan Imports of "Other" Planed Lumber
(Japan Tariff Association)
$CDN per m3
Canada
US
Other
14

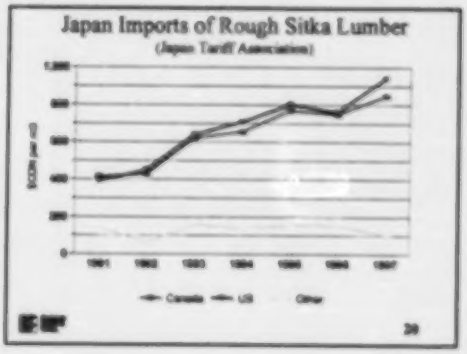

Japan Imports of Rough Pine Lumber
(Japan Tariff Association)
Cubic Metres
NZ
Chile
Other
15

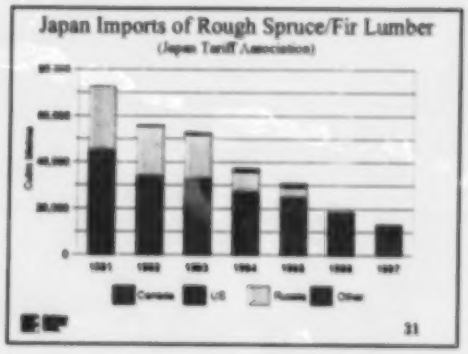

Japan Imports of Rough Pine Lumber
(Japan Tariff Association)
$CDN per m3
NZ
Chile
Other
16

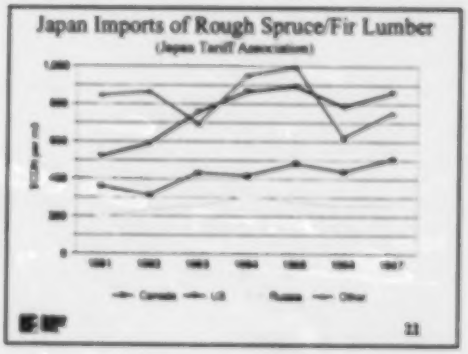

Japan Imports of Rough Sitka Lumber
(Japan Tariff Association)
Cubic Metres
<18 cm
>18 cm
17

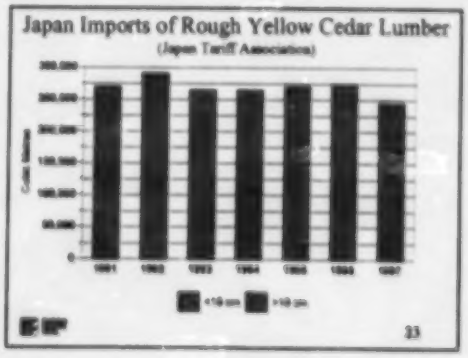
Japan Imports of Rough Sitka Lumber
(Japan Tariff Association)
$CDN per m3
<18 cm
>18 cm
18

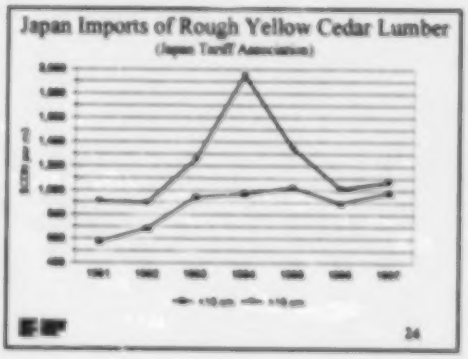
Japan Imports of Rough Sitka Lumber
(Japan Tariff Association)
Canada
US
Other
19

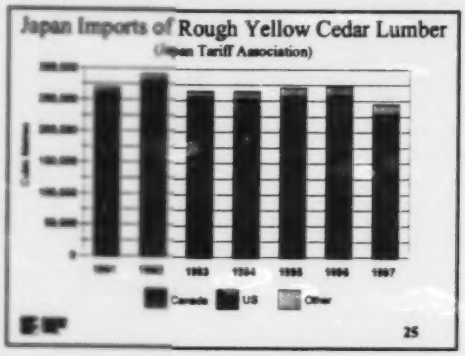

Japan Imports of Rough Sitka Lumber
(Japan Tariff Association)
Canada
US
Other
20

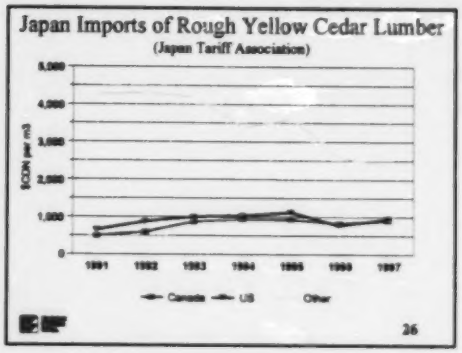

Japan Imports of Rough Spruce/Fir Lumber
(Japan Tariff Association)
Canada
US
Russia
Other
31

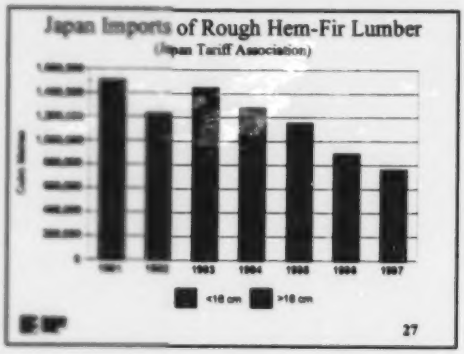

Japan Imports of Rough Spruce/Fir Lumber
(Japan Tariff Association)
Canada
US
Russia
Other
33

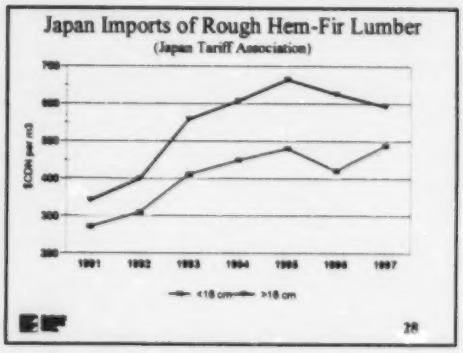

Japan Imports of Rough Yellow Cedar Lumber
(Japan Tariff Association)
<10 cm
>10 cm
23

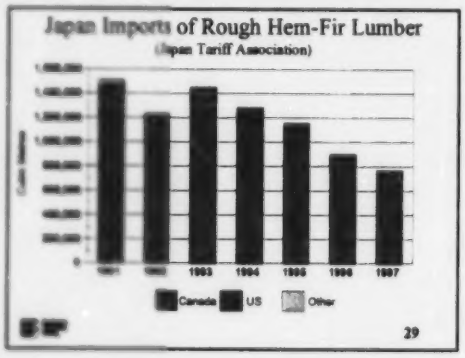

Japan Imports of Rough Yellow Cedar Lumber
(Japan Tariff Association)
<10 cm
>10 cm
24

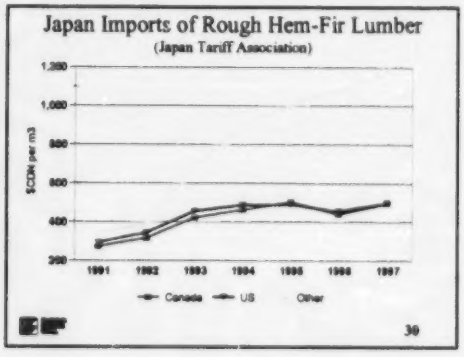

Japan Imports of Rough Yellow Cedar Lumber
(Japan Tariff Association)
Canada
US
Other
25

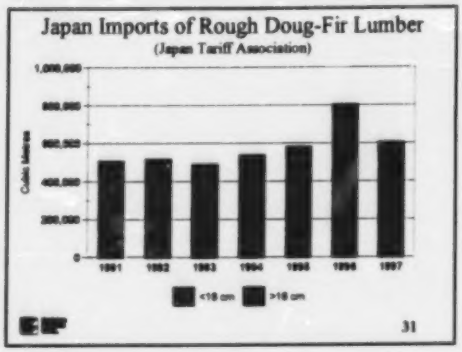

Japan Imports of Rough Yellow Cedar Lumber
(Japan Tariff Association)
$CDN per m3
Canada
US
Other
26

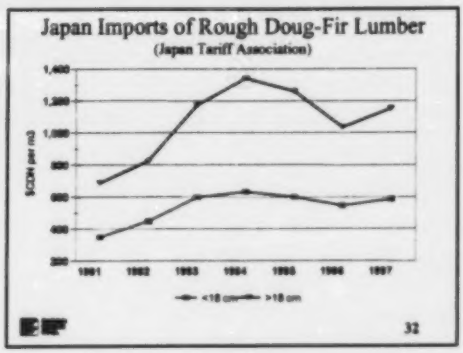

Japan Imports of Rough Hem-Fir Lumber
(Japan Tariff Association)
<18 cm
>18 cm
27

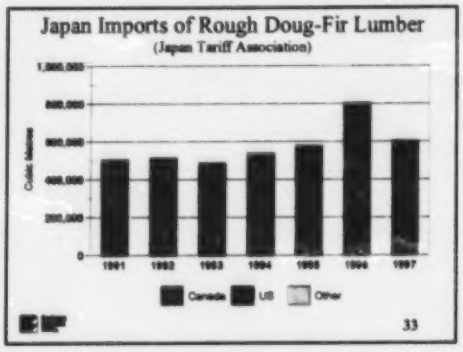

Japan Imports of Rough Hem-Fir Lumber
(Japan Tariff Association)
$CDN per m3
<18 cm
>18 cm
28

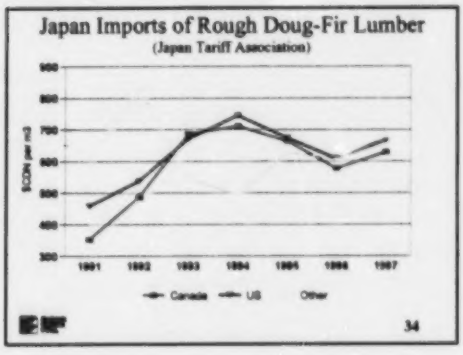

Japan Imports of Rough Hem-Fir Lumber
(Japan Tariff Association)
Canada
US
Other
29

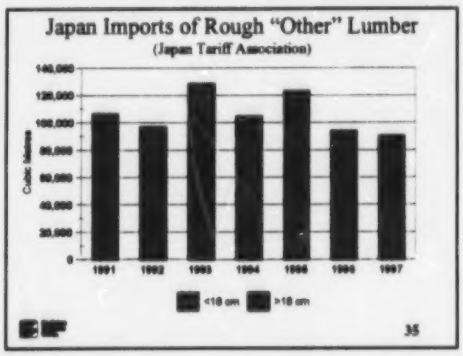

Japan Imports of Rough Hem-Fir Lumber
(Japan Tariff Association)
$CDN per m3
Canada
US
Other
30

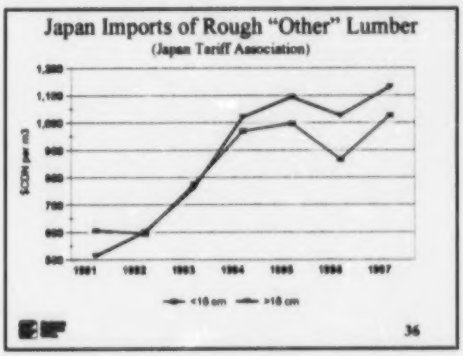

Japan Imports of Rough Doug-Fir Lumber
(Japan Tariff Association)
Cubic Metres
1991 1992 1993 1994 1995 1996 1997
<18 cm
>18 cm
31

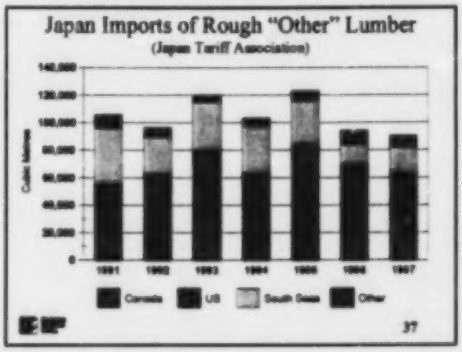

Japan Imports of Rough Doug-Fir Lumber
(Japan Tariff Association)
$CDN per m3
1991 1992 1993 1994 1995 1996 1997
<18 cm
>18 cm
32

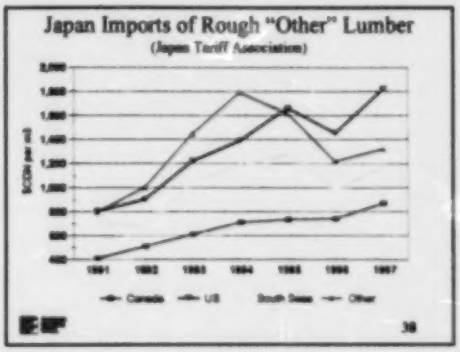

Japan Imports of Rough Doug-Fir Lumber
(Japan Tariff Association)
Cubic Metres
1991 1992 1993 1994 1995 1996 1997
Canada
US
Other
33


Japan Imports of Rough Doug-Fir Lumber
(Japan Tariff Association)
$CDN per m3
1991 1992 1993 1994 1995 1996 1997
Canada
US
Other
34

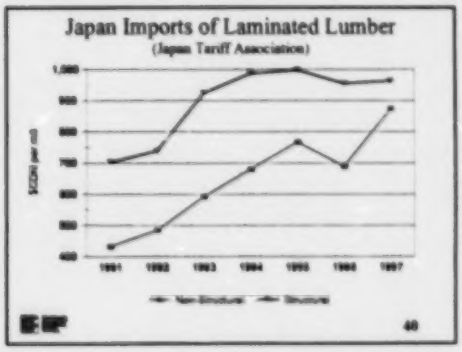

Japan Imports of Rough "Other" Lumber
(Japan Tariff Association)
Cubic Metres
1991 1992 1993 1994 1995 1996 1997
<18 cm
>18 cm
35

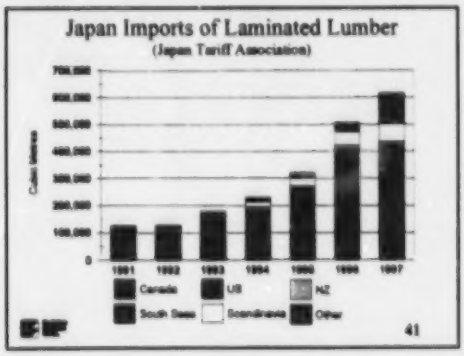

Japan Imports of Rough "Other" Lumber
(Japan Tariff Association)
$CDN per m3
1991 1992 1993 1994 1995 1996 1997
<18 cm
>18 cm
36

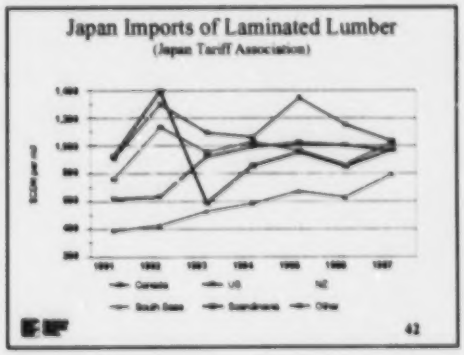

Japan Imports of Rough "Other" Lumber
(Japan Tariff Association)
Cubic Metres
1991
1992
1993
1994
1995
1996
1997
Canada
US
South Seas
Other
37

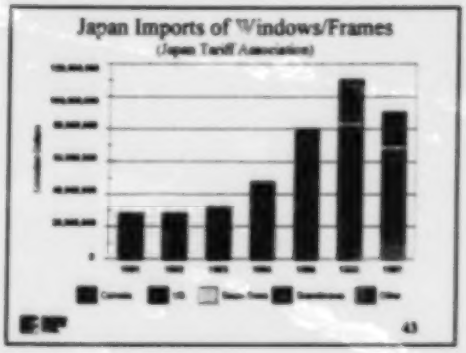

Japan Imports of Rough "Other" Lumber
(Japan Tariff Association)
$CDN per m3
1991
1992
1993
1994
1995
1996
1997
Canada
US
South Seas
Other
38

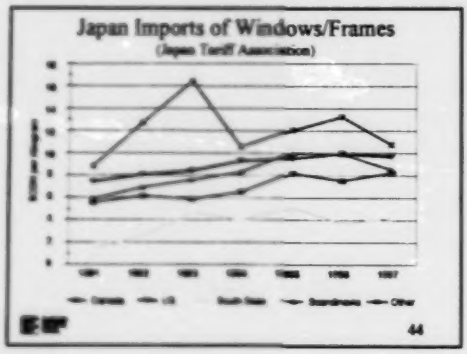
Japan Imports of Laminated Lumber
(Japan Tariff Association)
Cubic Metres
1991
1992
1993
1994
1995
1996
1997
Non-Structural
Structural
39

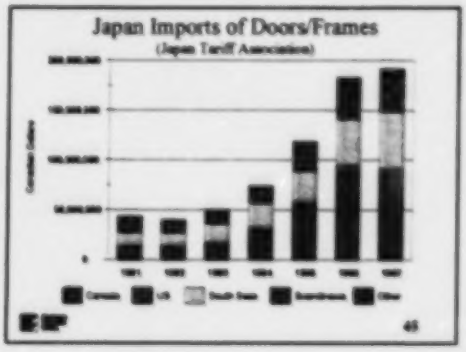

Japan Imports of Laminated Lumber
(Japan Tariff Association)
$CDN per m3
1991
1992
1993
1994
1995
1996
1997
Non-Structural
Structural
40

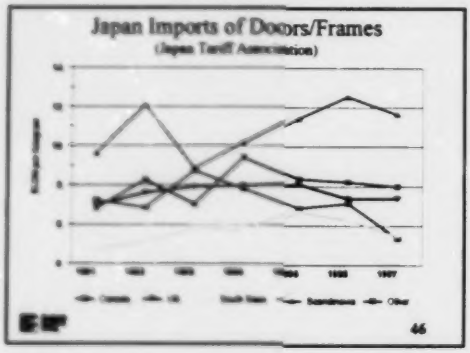

Japan Imports of Laminated Lumber
(Japan Tariff Association)
Cubic Metres
1991
1992
1993
1994
1995
1996
1997
Canada
US
NZ
South Seas
Scandinavia
Other
41


Japan Imports of Laminated Lumber
(Japan Tariff Association)
$CDN per m3
1991
1992
1993
1994
1995
1996
1997
Canada
US
NZ
South Seas
Scandinavia
Other
42

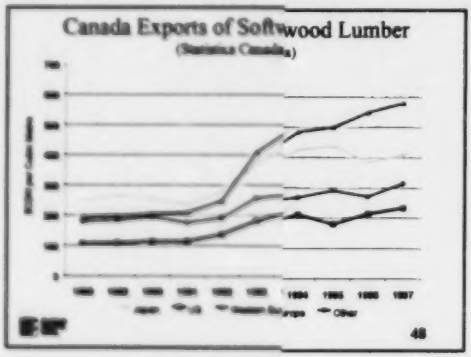

Japan Imports of Windows/Frames
(Japan Tariff Association)
43

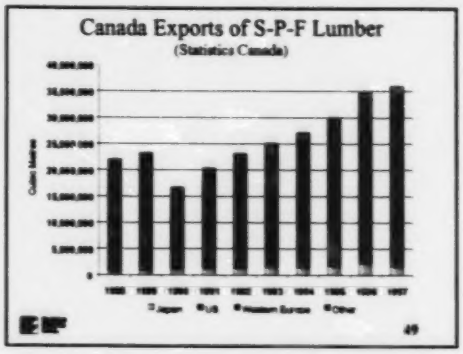

Japan Imports of Windows/Frames
(Japan Tariff Association)
44

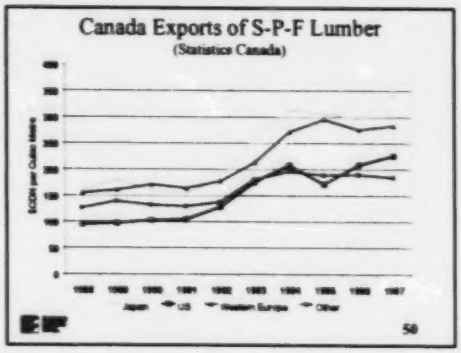

Japan Imports of Doors/Frames
(Japan Tariff Association)
45

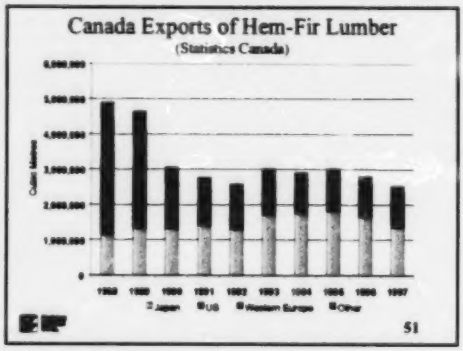

Japan Imports of Doors/Frames
(Japan Tariff Association)
46

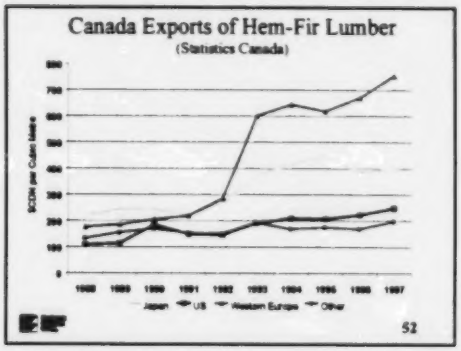
Canada Exports of Softwood Lumber
(Statistics Canada)
47

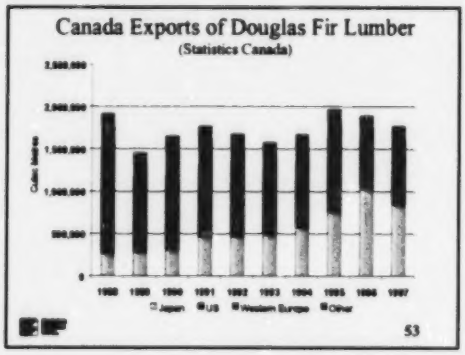

Canada Exports of Softwood Lumber
(Statistics Canada)
48

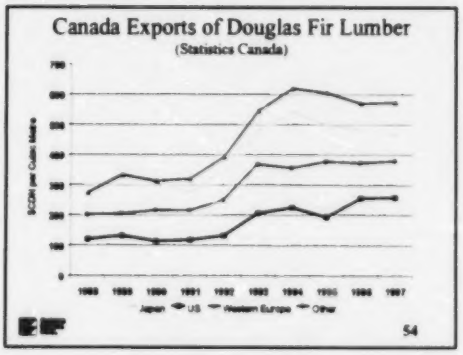

Canada Exports of S-P-F Lumber
(Statistics Canada)
49

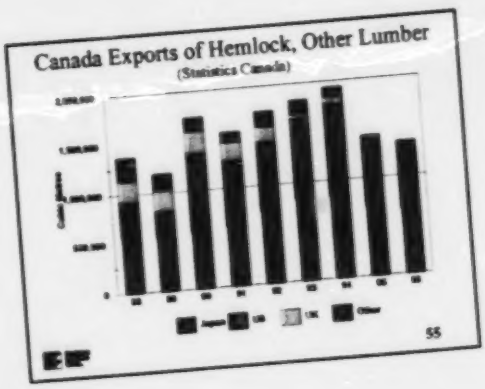

Canada Exports of S-P-F Lumber
(Statistics Canada)
50

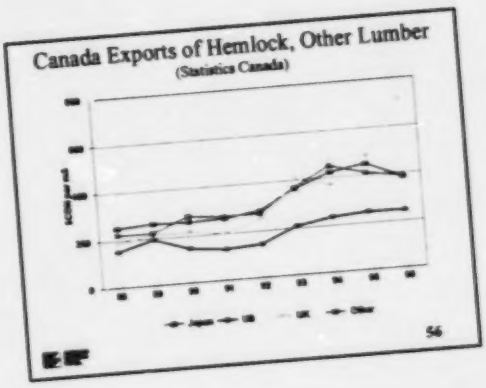

Canada Exports of Hem-Fir Lumber
(Statistics Canada)
51

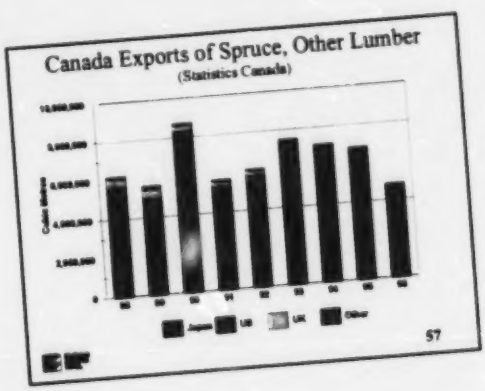

Canada Exports of Hem-Fir Lumber
(Statistics Canada)
52

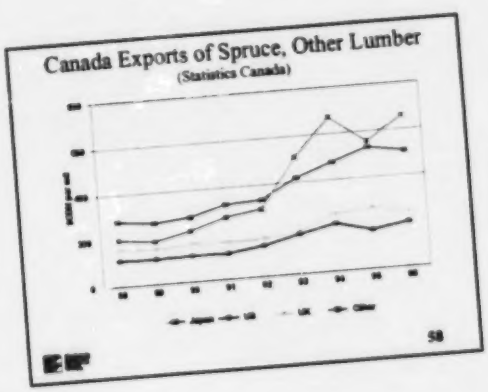

Canada Exports of Douglas Fir Lumber
(Statistics Canada)
53

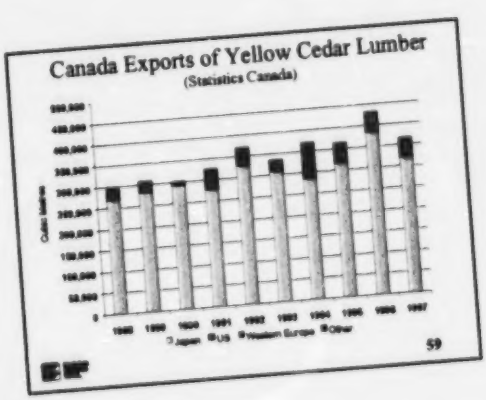

Canada Exports of Douglas Fir Lumber
(Statistics Canada)
54

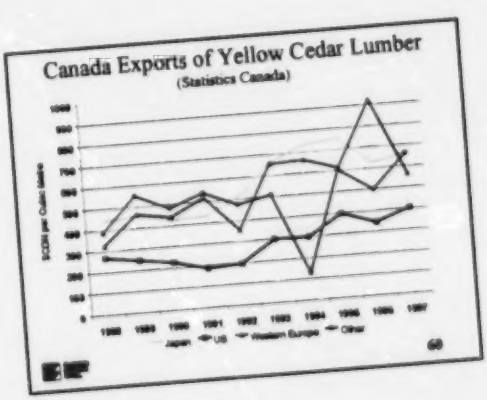

Canada Exports of Hemlock, Other Lumber
(Statistics Canada)
55

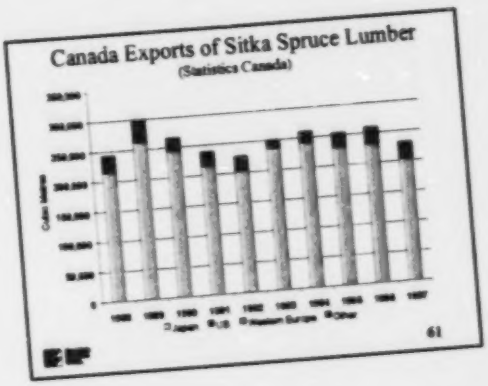

Canada Exports of Hemlock, Other Lumber
(Statistics Canada)
56

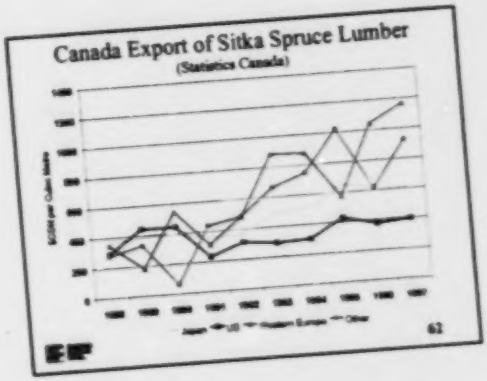

Canada Exports of Spruce, Other Lumber
(Statistics Canada)
57

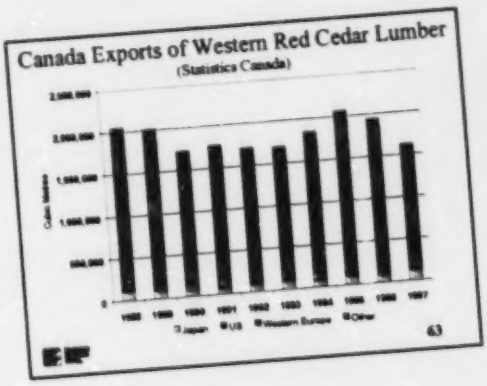

Canada Exports of Spruce, Other Lumber
(Statistics Canada)
58

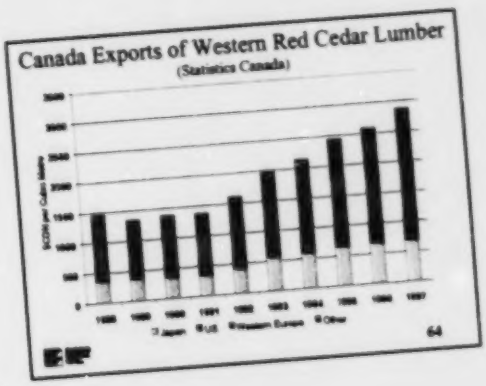

Canada Exports of Yellow Cedar Lumber
(Statistics Canada)
59

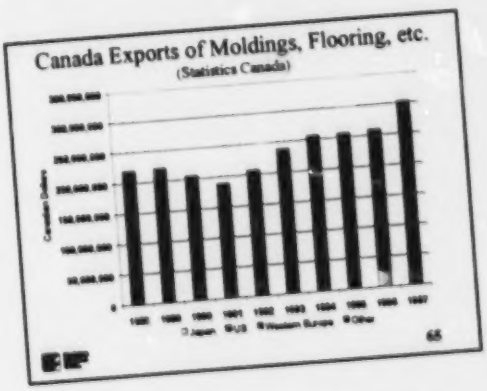

Canada Exports of Yellow Cedar Lumber
(Statistics Canada)
60

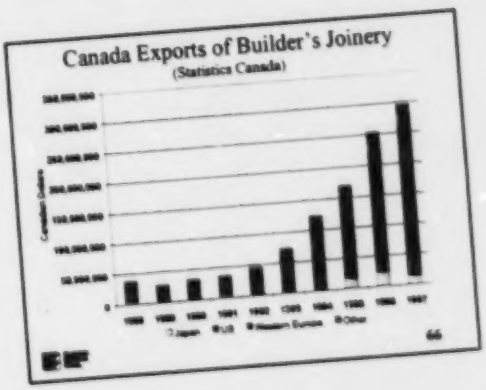

Canada Exports of Sitka Spruce Lumber
(Statistics Canada)
61


Canada Export of Sitka Spruce Lumber
(Statistics Canada)
62


Canada Exports of Western Red Cedar Lumber
(Statistics Canada)
63

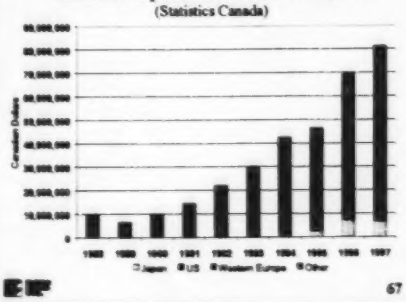

Canada Exports of Western Red Cedar Lumber
(Statistics Canada)
64


Canada Exports of Moldings, Flooring, etc.
(Statistics Canada)
65


Canada Exports of Builder's Joinery
(Statistics Canada)
66

Canada Exports of Wood Windows

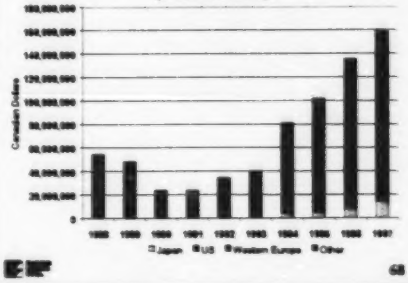
(Statistics Canada)



67

Canada Exports of Wood Doors

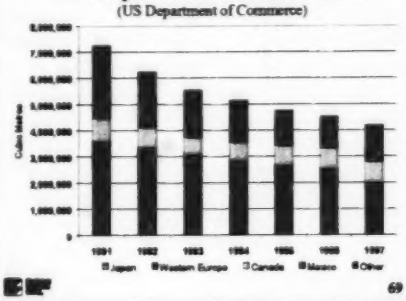
(Statistics Canada)



68

US Exports of Softwood Lumber

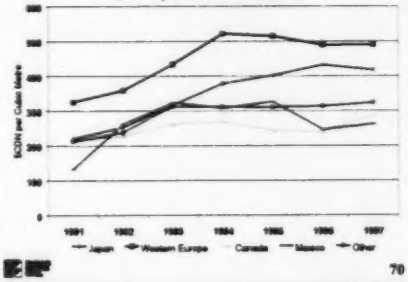
(US Department of Commerce)



69

US Exports of Softwood Lumber

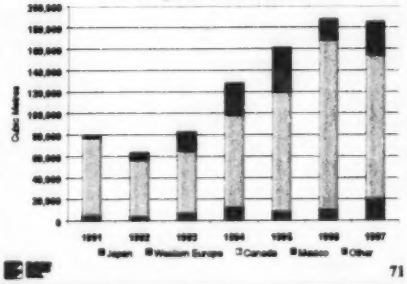
(US Department of Commerce)



70

US Exports of S-P-F Lumber

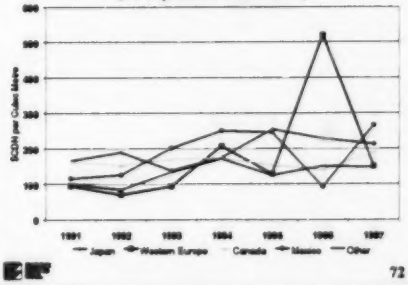
(US Department of Commerce)



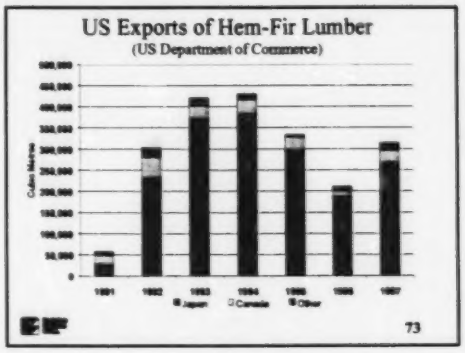
71

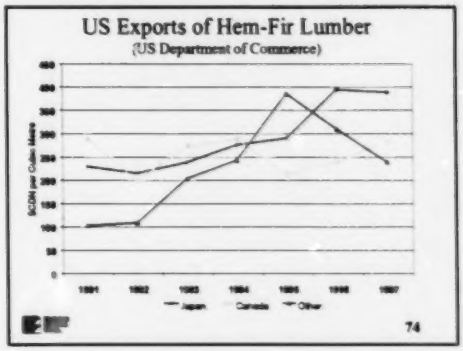
US Exports of S-P-F Lumber

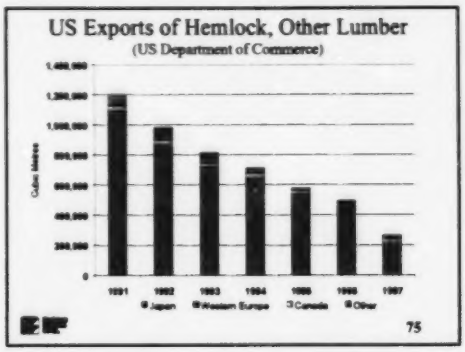
(US Department of Commerce)

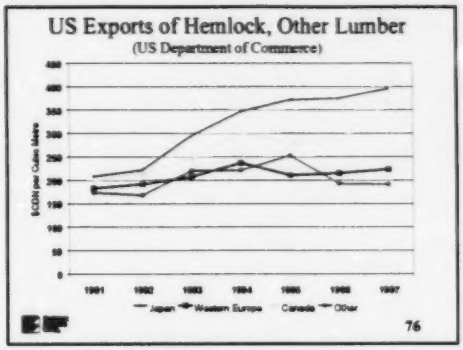


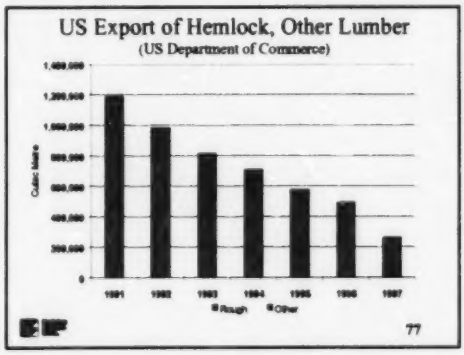
72

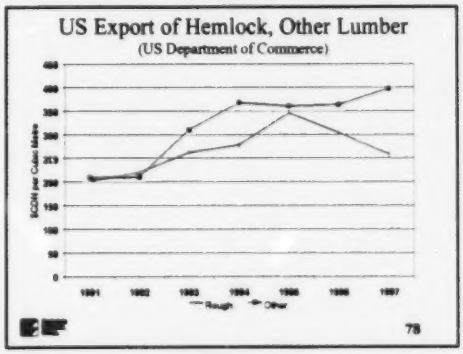

US Exports of Hem-Fir Lumber
(US Department of Commerce)
Cubic Metres
Japan
Canada
Other
73

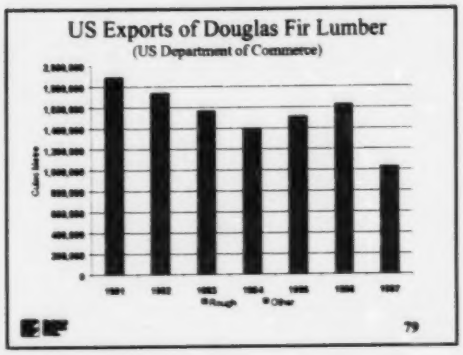

US Exports of Hem-Fir Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Japan
Canada
Other
74

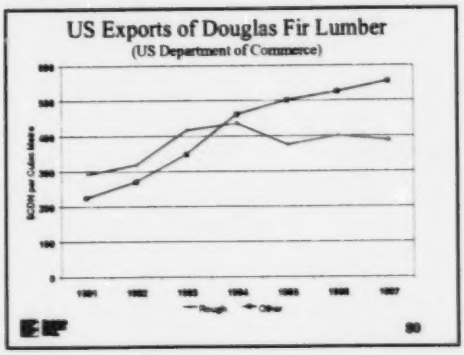

US Exports of Hemlock, Other Lumber
(US Department of Commerce)
Cubic Metres
Japan
Western Europe
Canada
Other
75

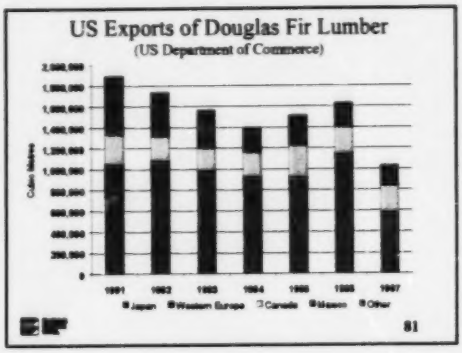

US Exports of Hemlock, Other Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Japan
Western Europe
Canada
Other
76

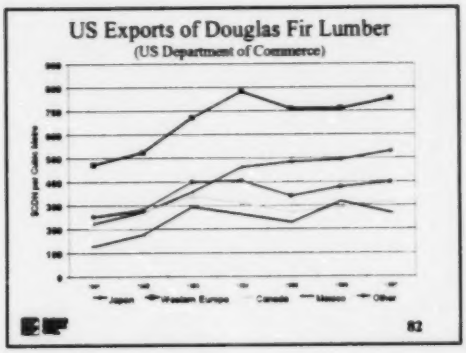

US Export of Hemlock, Other Lumber
(US Department of Commerce)
Cubic Metres
Rough
Other
77

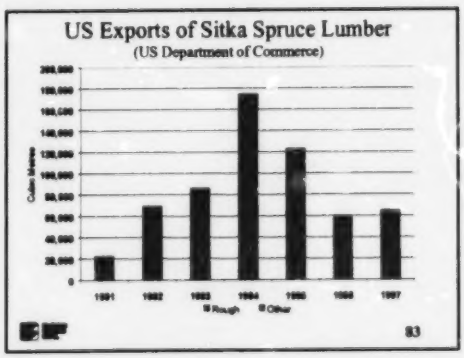

US Export of Hemlock, Other Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Rough
Other
78

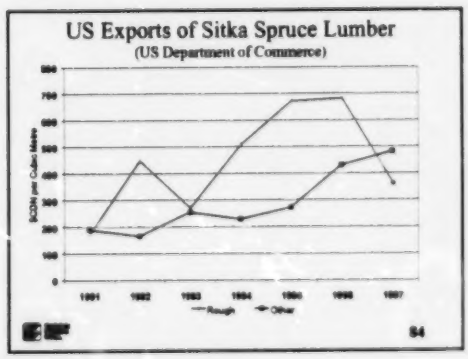

US Exports of Douglas Fir Lumber
(US Department of Commerce)
Cubic Metres
Rough
Other
79

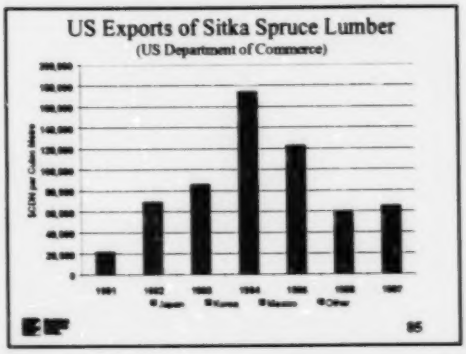

US Exports of Douglas Fir Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Rough
Other
80

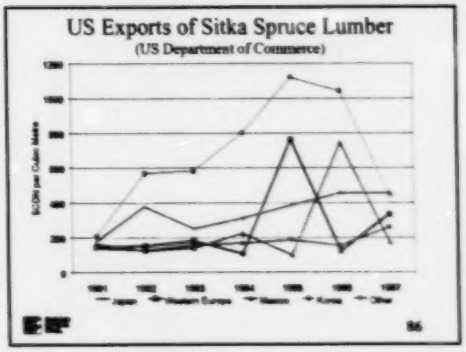

US Exports of Douglas Fir Lumber
(US Department of Commerce)
Cubic Metres
Japan
Western Europe
Canada
Mexico
Other
81

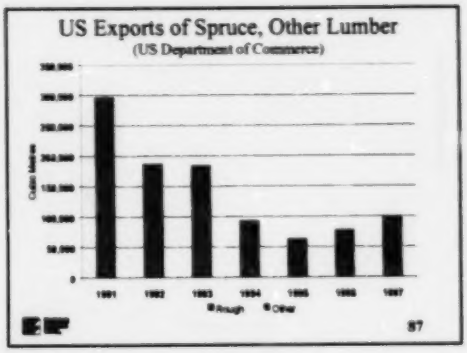

US Exports of Douglas Fir Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Japan
Western Europe
Canada
Mexico
Other
82

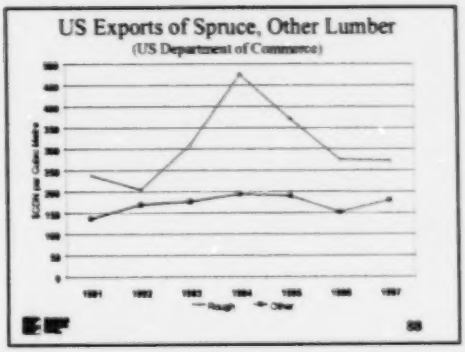

US Exports of Sitka Spruce Lumber
(US Department of Commerce)
Cubic Metres
Rough
Other
83

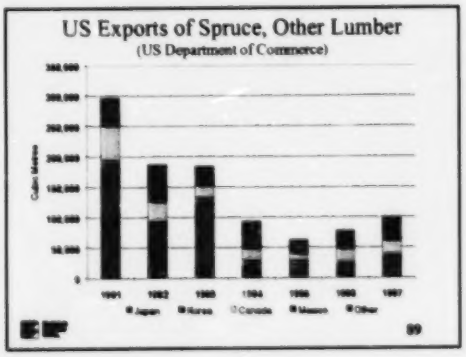

US Exports of Sitka Spruce Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Rough
Other
84

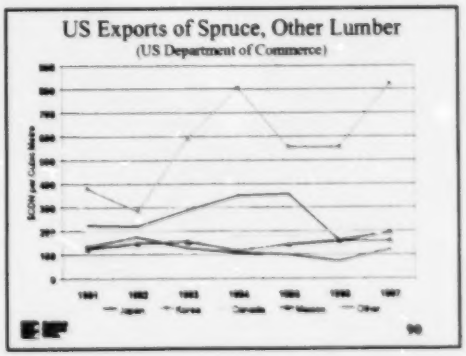

US Exports of Sitka Spruce Lumber
(US Department of Commerce)
85

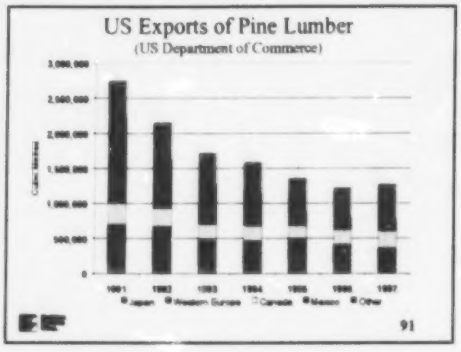

US Exports of Sitka Spruce Lumber
(US Department of Commerce)
86

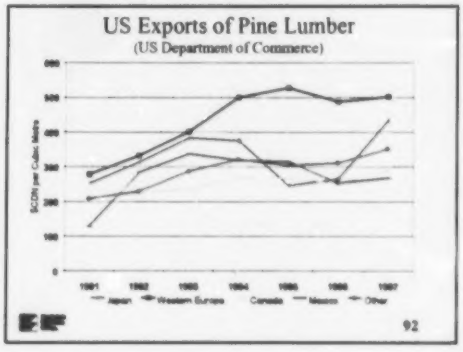

US Exports of Spruce, Other Lumber
(US Department of Commerce)
87

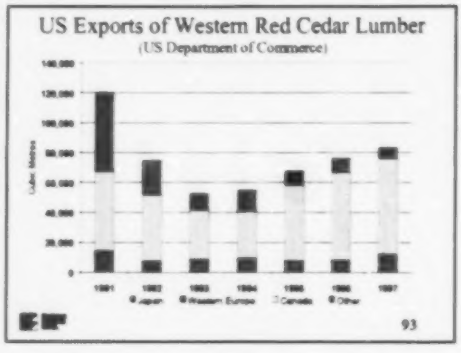

US Exports of Spruce, Other Lumber
(US Department of Commerce)
88

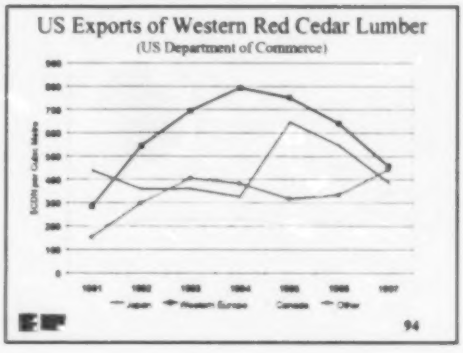

US Exports of Spruce, Other Lumber
(US Department of Commerce)
89

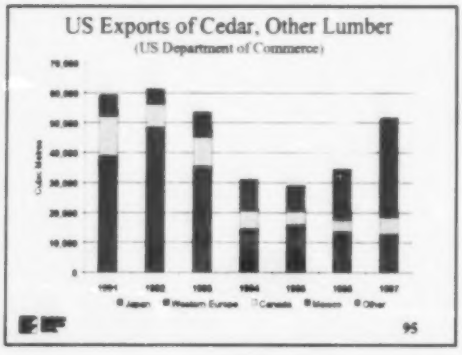

US Exports of Spruce, Other Lumber
(US Department of Commerce)
90

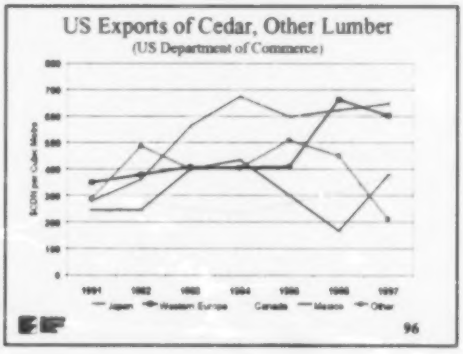

US Exports of Pine Lumber
(US Department of Commerce)
91

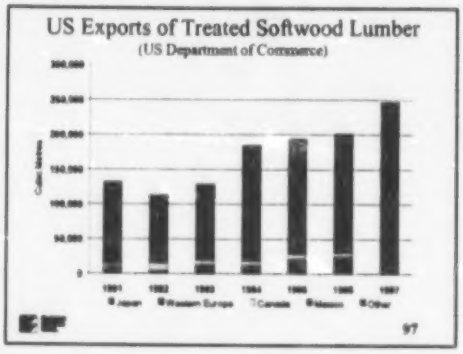

US Exports of Pine Lumber
(US Department of Commerce)
92

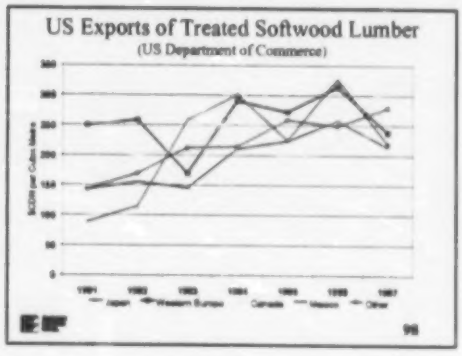

US Exports of Western Red Cedar Lumber
(US Department of Commerce)
93

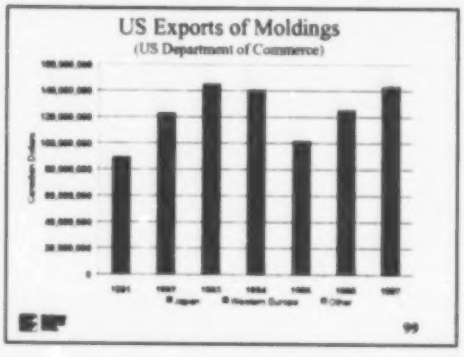

US Exports of Western Red Cedar Lumber
(US Department of Commerce)
94

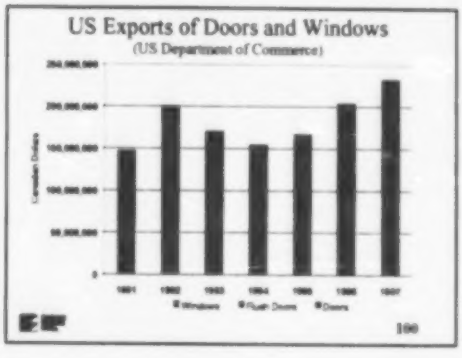

US Exports of Cedar, Other Lumber
(US Department of Commerce)
95

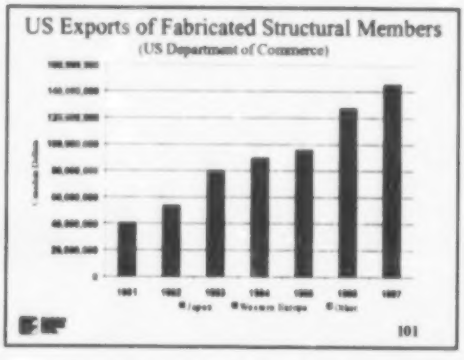

US Exports of Cedar, Other Lumber
(US Department of Commerce)
96


US Exports of Treated Softwood Lumber
(US Department of Commerce)
97

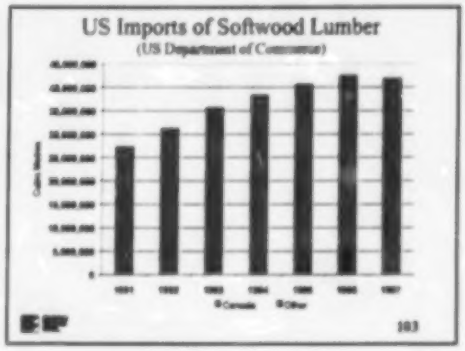

US Exports of Treated Softwood Lumber
(US Department of Commerce)
98

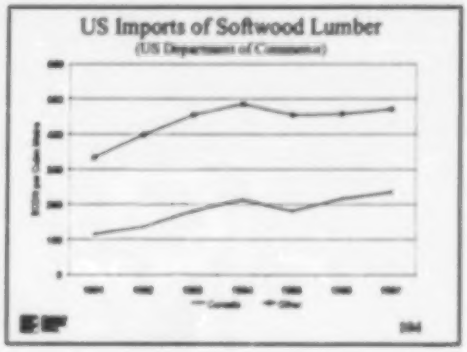

US Exports of Moldings
(US Department of Commerce)
99

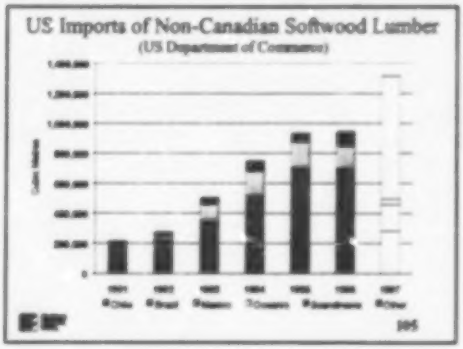

US Exports of Doors and Windows
(US Department of Commerce)
100

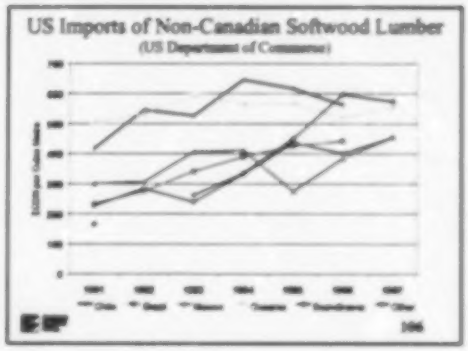

US Exports of Fabricated Structural Members
(US Department of Commerce)
101

102

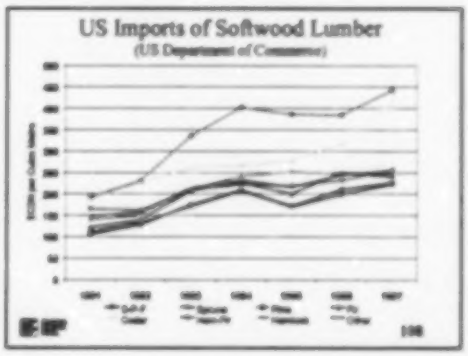

US Imports of Softwood Lumber
(US Department of Commerce)
103

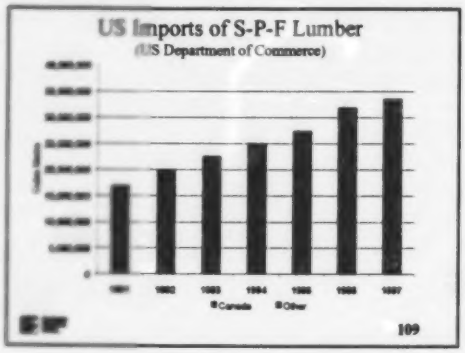

US Imports of Softwood Lumber
(US Department of Commerce)
104

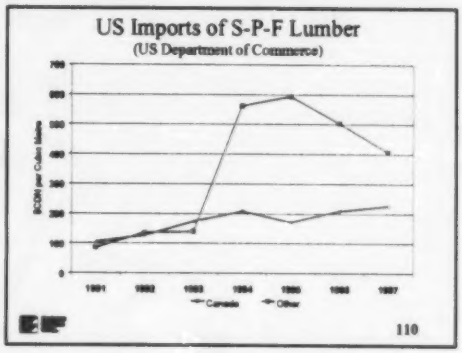

US Imports of Non-Canadian Softwood Lumber
(US Department of Commerce)
105

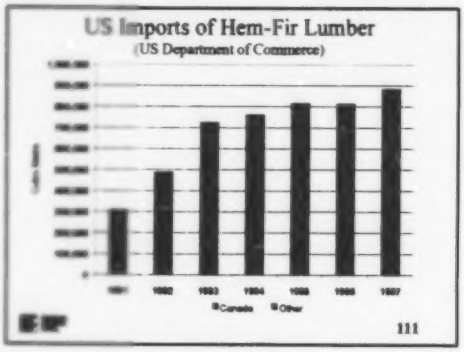

US Imports of Non-Canadian Softwood Lumber
(US Department of Commerce)
106

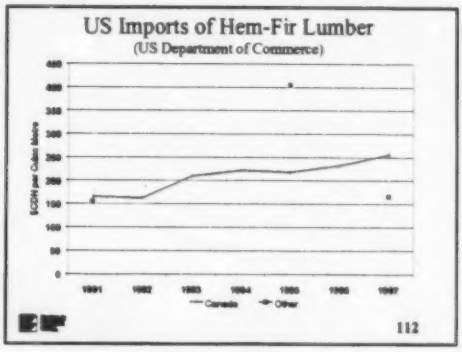
US Imports of Softwood Lumber
(US Department of Commerce)
107

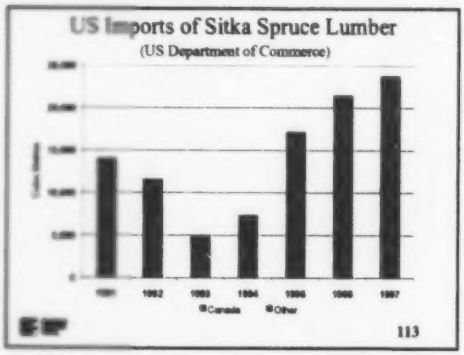

US Imports of Softwood Lumber
(US Department of Commerce)
108

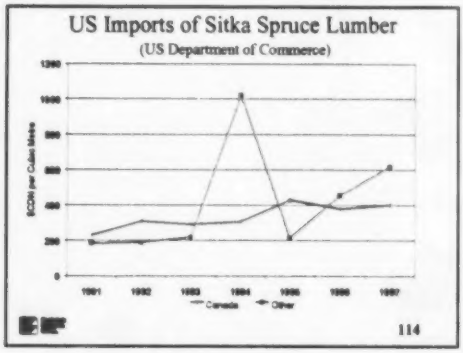

US Imports of S-P-F Lumber
(US Department of Commerce)
Canada
Other
109

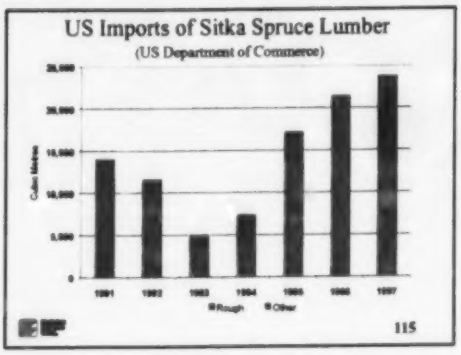

US Imports of S-P-F Lumber
(US Department of Commerce)
Canada
Other
110

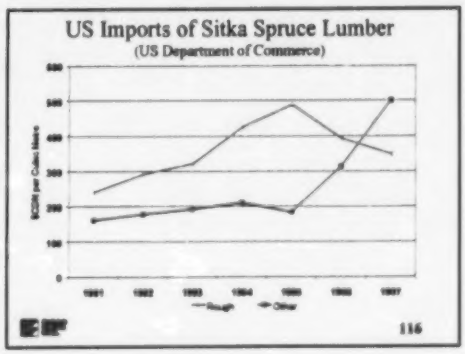

US Imports of Hem-Fir Lumber
(US Department of Commerce)
Canada
Other
111

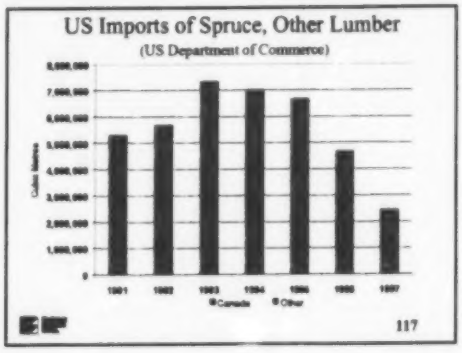

US Imports of Hem-Fir Lumber
(US Department of Commerce)
Canada
Other
112

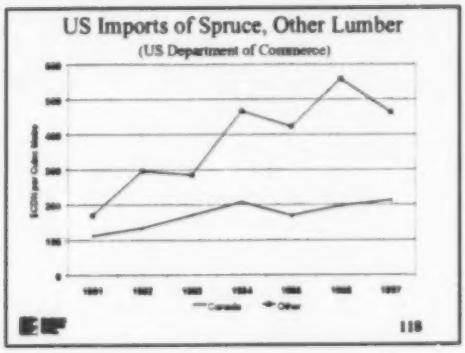

US Imports of Sitka Spruce Lumber
(US Department of Commerce)
Canada
Other
113

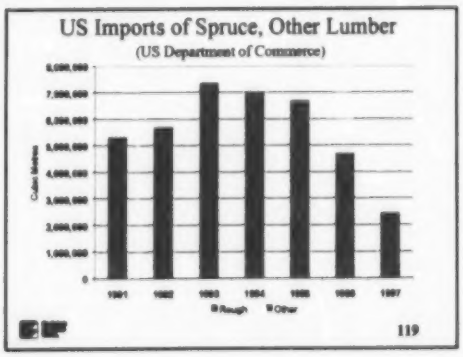

US Imports of Sitka Spruce Lumber
(US Department of Commerce)
Canada
Other
114

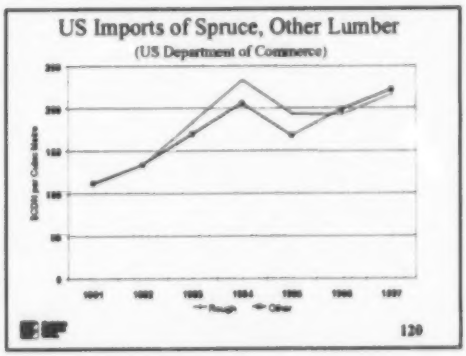

US Imports of Sitka Spruce Lumber
(US Department of Commerce)
Cubic Metres
1991
1992
1993
1994
1995
1996
1997
Rough
Other
115

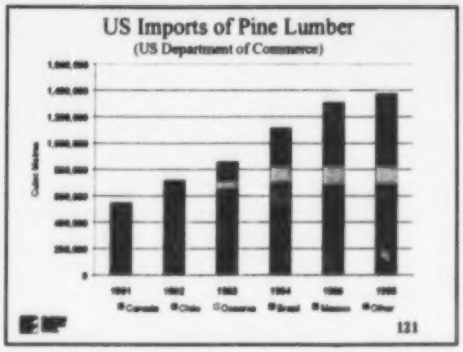

US Imports of Sitka Spruce Lumber
(US Department of Commerce)
$CDN per Cubic Metre
1991
1992
1993
1994
1995
1996
1997
Rough
Other
116

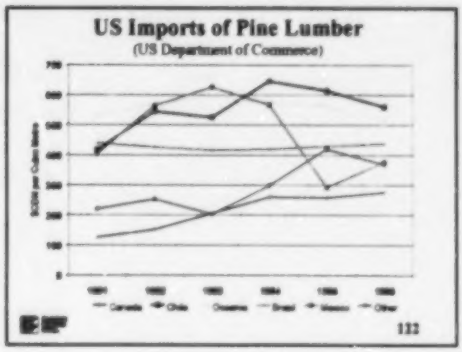

US Imports of Spruce, Other Lumber
(US Department of Commerce)
Cubic Metres
1991
1992
1993
1994
1995
1996
1997
Canada
Other
117

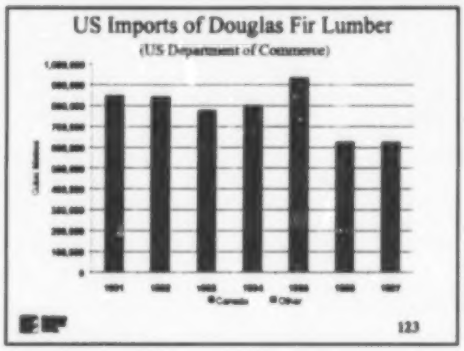

US Imports of Spruce, Other Lumber
(US Department of Commerce)
$CDN per Cubic Metre
1991
1992
1993
1994
1995
1996
1997
Canada
Other
118

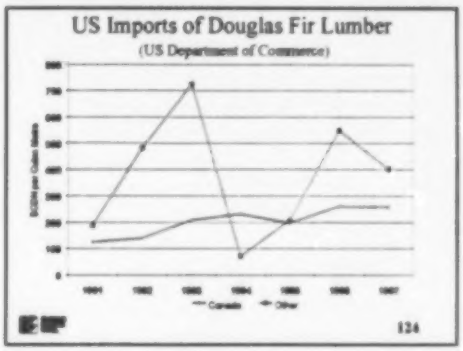

US Imports of Spruce, Other Lumber
(US Department of Commerce)
Cubic Metres
1991
1992
1993
1994
1995
1996
1997
Rough
Other
119

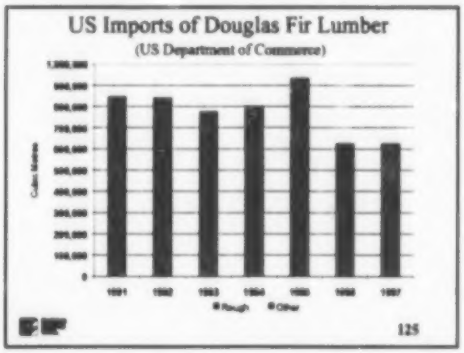

US Imports of Spruce, Other Lumber
(US Department of Commerce)
$CDN per Cubic Metre
1991
1992
1993
1994
1995
1996
1997
Rough
Other
120

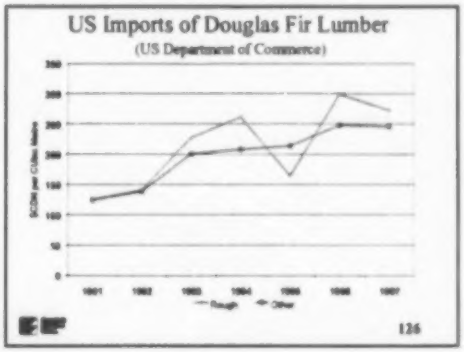

US Imports of Pine Lumber
(US Department of Commerce)
121

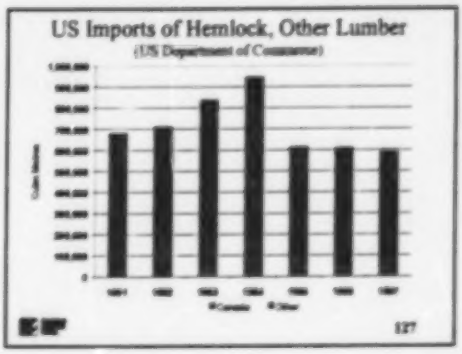

US Imports of Pine Lumber
(US Department of Commerce)
122

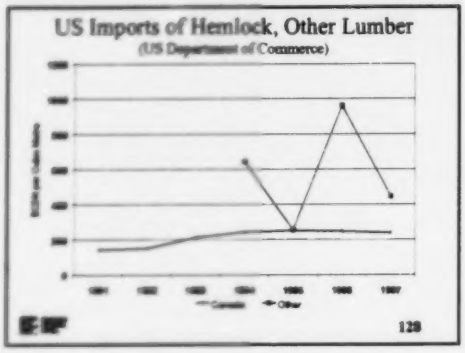

US Imports of Douglas Fir Lumber
(US Department of Commerce)
123

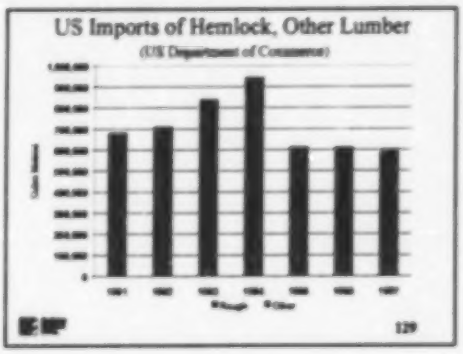

US Imports of Douglas Fir Lumber
(US Department of Commerce)
124

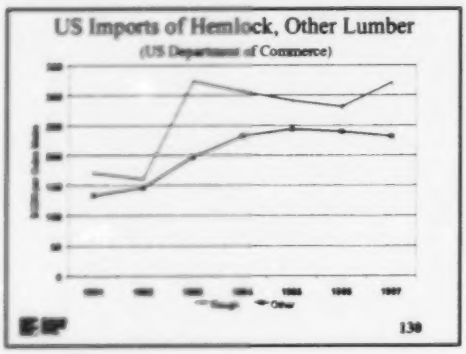

US Imports of Douglas Fir Lumber
(US Department of Commerce)
125

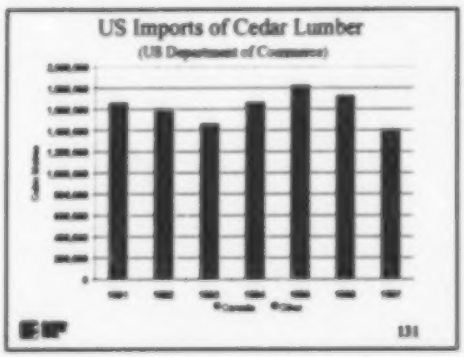

US Imports of Douglas Fir Lumber
(US Department of Commerce)
126

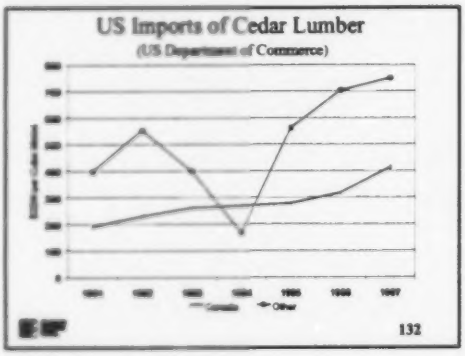

US Imports of Hemlock, Other Lumber
(US Department of Commerce)
127

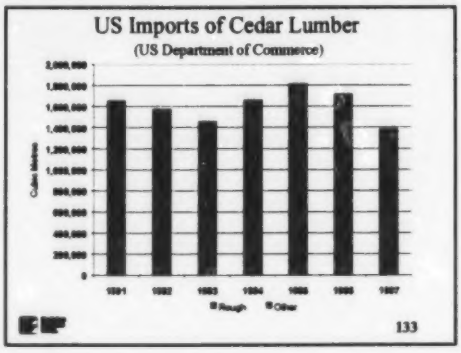

US Imports of Hemlock, Other Lumber
(US Department of Commerce)
128

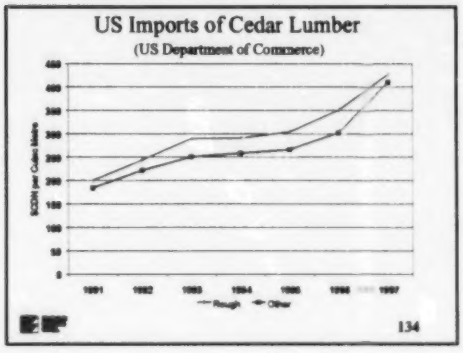

US Imports of Hemlock, Other Lumber
(US Department of Commerce)
129

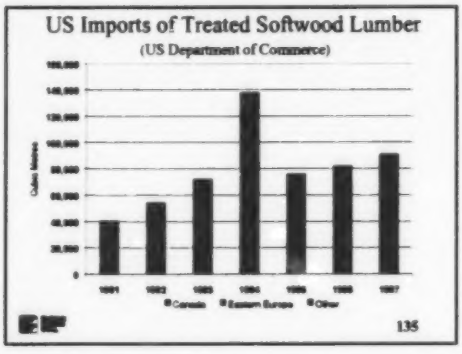

US Imports of Hemlock, Other Lumber
(US Department of Commerce)
130

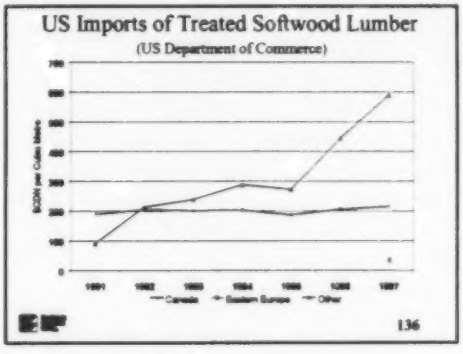

US Imports of Cedar Lumber
(US Department of Commerce)
131

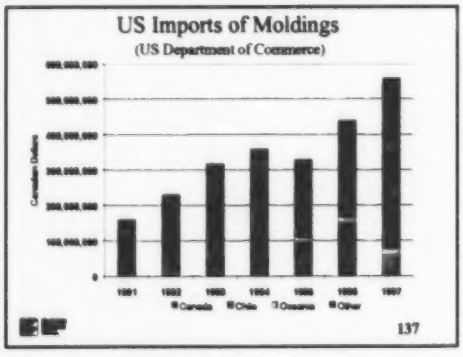

US Imports of Cedar Lumber
(US Department of Commerce)
132

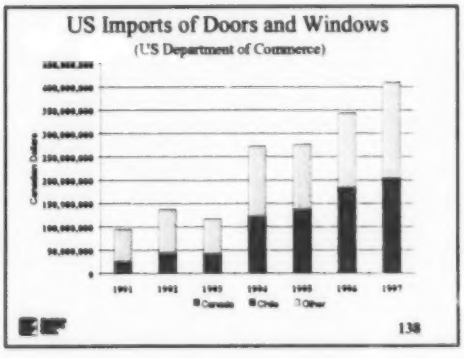

US Imports of Cedar Lumber
(US Department of Commerce)
Cubic Metres
Rough
Other
133


US Imports of Cedar Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Rough
Other
134


US Imports of Treated Softwood Lumber
(US Department of Commerce)
Cubic Metres
Canada
Eastern Europe
Other
135

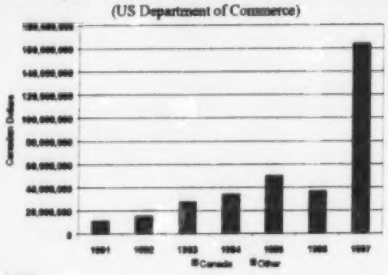

US Imports of Treated Softwood Lumber
(US Department of Commerce)
$CDN per Cubic Metre
Canada
Eastern Europe
Other
136


US Imports of Moldings
(US Department of Commerce)
Canadian Dollars
Canada
Chile
Oceania
Other
137


US Imports of Doors and Windows
(US Department of Commerce)
Canadian Dollars
Canada
Chile
Other
138

US Imports of Fabricated Structural Members

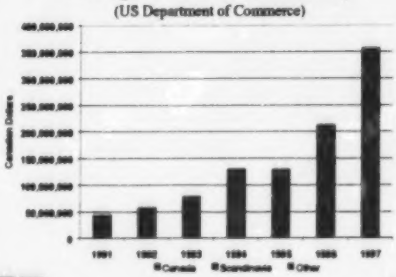
(US Department of Commerce)



139

US Imports of Builder's Joinery

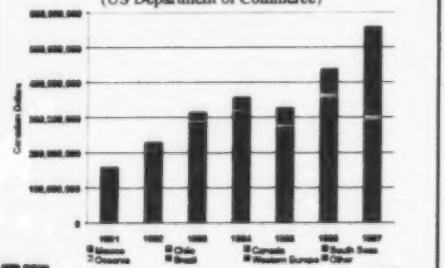
(US Department of Commerce)



140

US Imports of Moldings

(US Department of Commerce)

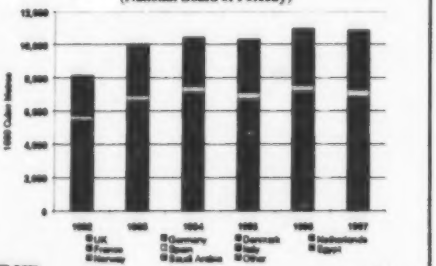


141

142

Sweden Exports of Softwood Lumber

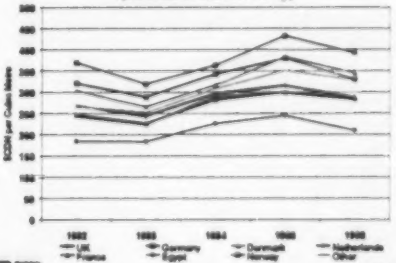
(National Board of Forestry)



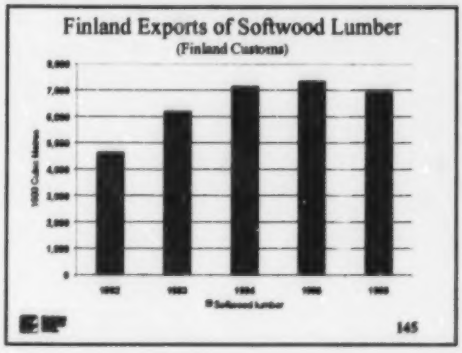
143

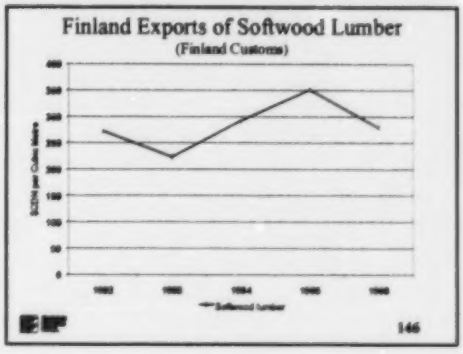
Sweden Exports of Softwood Lumber

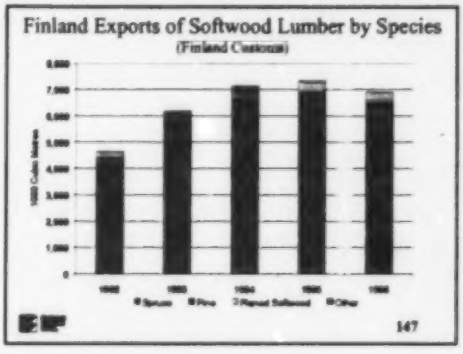
(National Board of Forestry)

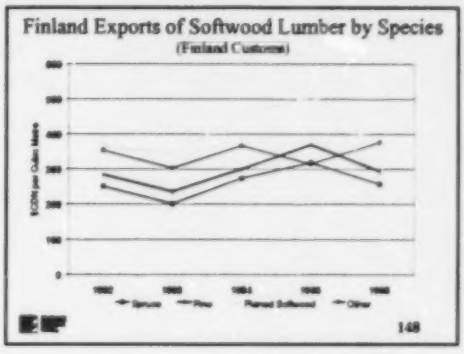


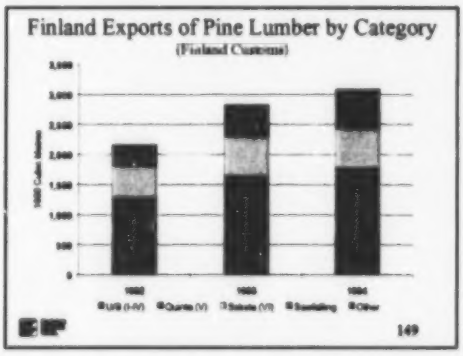
144

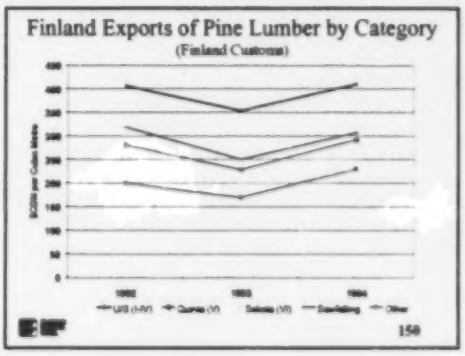

Finland Exports of Softwood Lumber
(Finland Customs)
145

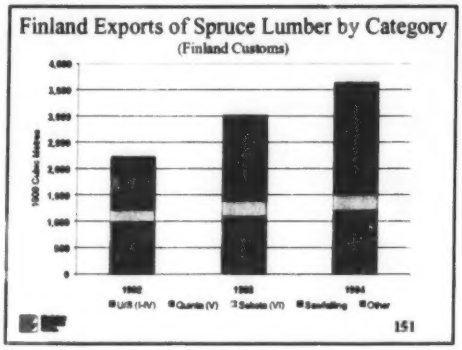

Finland Exports of Softwood Lumber
(Finland Customs)
146

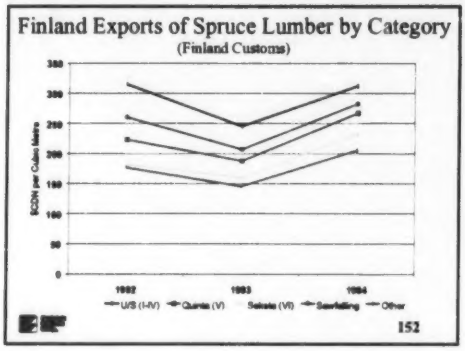

Finland Exports of Softwood Lumber by Species
(Finland Customs)
147

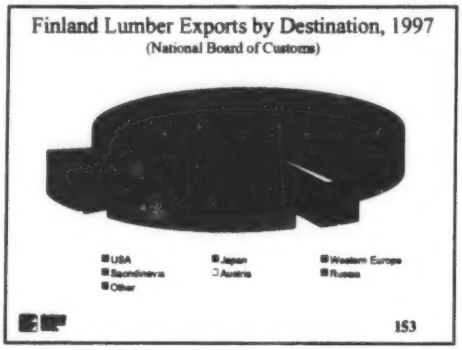

Finland Exports of Softwood Lumber by Species
(Finland Customs)
148

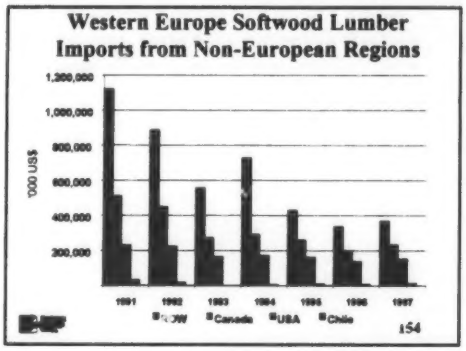

Finland Exports of Pine Lumber by Category
(Finland Customs)
149

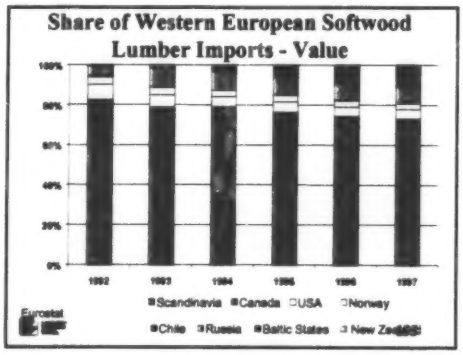

Finland Exports of Pine Lumber by Category
(Finland Customs)
150

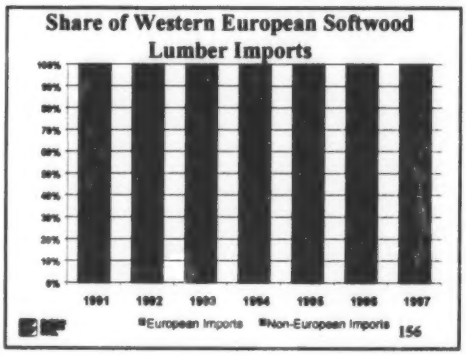

Finland Exports of Spruce Lumber by Category
(Finland Customs)
1000 Cubic Metres
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1992
1993
1994
UKS (I-IV)
Quinta (V)
Sekota (VI)
Sawfalling
Other
151

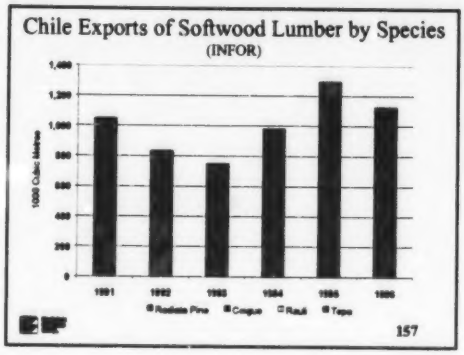

Finland Exports of Spruce Lumber by Category
(Finland Customs)
SCDN per Cubic Metre
300
250
200
150
100
50
0
1992
1993
1994
UKS (I-IV)
Quinta (V)
Sekota (VI)
Sawfalling
Other
152

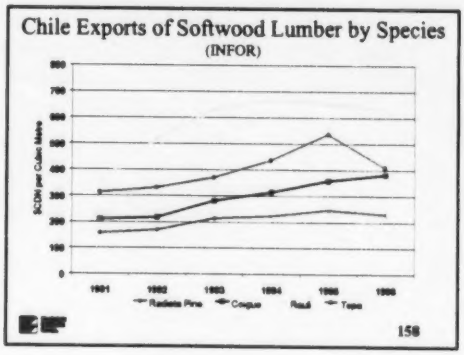

Finland Lumber Exports by Destination, 1997
(National Board of Customs)
USA
Japan
Western Europe
Scandinavia
Austria
Russia
Other
153

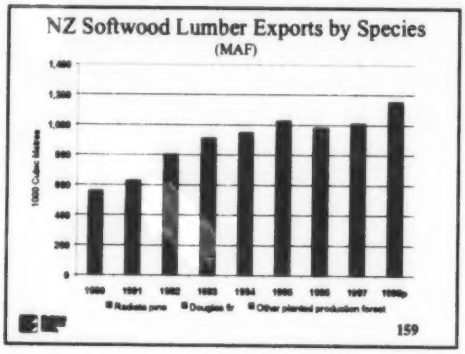

Western Europe Softwood Lumber
Imports from Non-European Regions
'000 US$
1,200,000
1,000,000
800,000
600,000
400,000
200,000
1991
1992
1993
1994
1995
1996
1997
ROW
Canada
USA
Chile
154

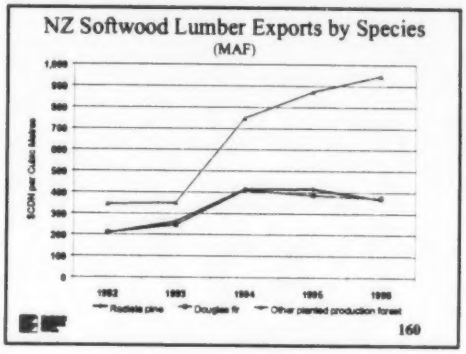

Share of Western European Softwood
Lumber Imports - Value
100%
80%
60%
40%
20%
0%
1992
1993
1994
1995
1996
1997
Scandinavia
Canada
USA
Norway
Chile
Russia
Baltic States
Eurostat

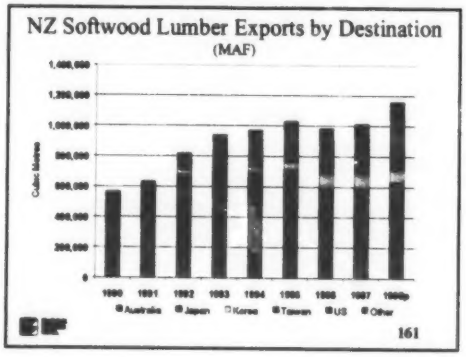

Share of Western European Softwood
Lumber Imports
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1991
1992
1993
1994
1995
1996
1997
European Imports
Non-European Imports
156

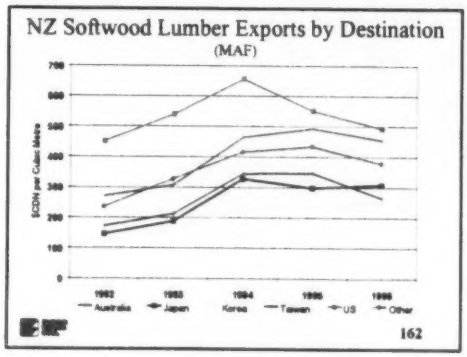

Chile Exports of Softwood Lumber by Species
(INFOR)
1000 Cubic Metres
Radiata Pine
Coigue
Raulí
Teps
157

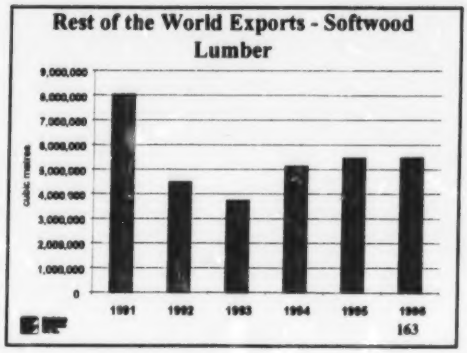

Chile Exports of Softwood Lumber by Species
(INFOR)
$CDN per Cubic Metre
Radiata Pine
Coigue
Raulí
Teps
158

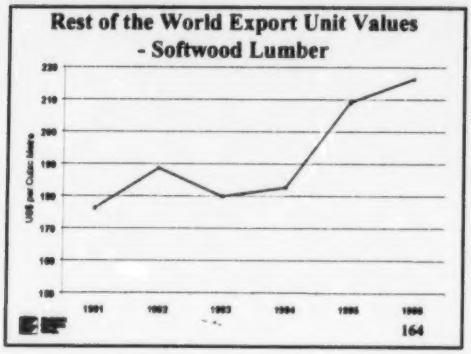

NZ Softwood Lumber Exports by Species
(MAF)
1000 Cubic Metres
Radiata pine
Douglas fir
Other planted production forest
159

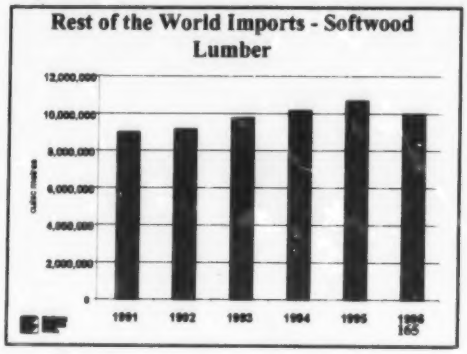

NZ Softwood Lumber Exports by Species
(MAF)
$CDN per Cubic Metre
Radiata pine
Douglas fir
Other planted production forest
160

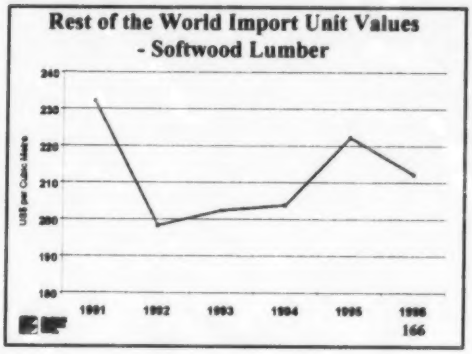

NZ Softwood Lumber Exports by Destination
(MAF)
Cubic Metres
Australia
Japan
Korea
Taiwan
US
Other
161


NZ Softwood Lumber Exports by Destination
(MAF)
$CDN per Cubic Metre
Australia
Japan
Korea
Taiwan
US
Other
162


Rest of the World Exports - Softwood Lumber
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
cubic metres
1991
1992
1993
1994
1995
1996
163


Rest of the World Export Unit Values - Softwood Lumber
230
210
200
190
180
170
160
150
US$ per Cubic Metre
1991
1992
1993
1994
1995
1996
164


Rest of the World Imports - Softwood Lumber
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
0
cubic metres
1991
1992
1993
1994
1995
1996
165


Rest of the World Import Unit Values - Softwood Lumber
240
230
220
210
200
190
180
US$ per Cubic Metre
1991
1992
1993
1994
1995
1996
166

Appendix Two

Project Steering Committee

Mike Ainsworth	Ainsworth Lumber Co. Ltd.
Morris Douglas	Riverside Forest Products Limited
Mike Fortune	Kooteny School of Art
Joe Heath	West Fraser Timber Co. Ltd.
Bob Holm	BC Wood
Greg Jadrzyk	NFPA/SPF Working Group
Lowell Johnson	Northwood Pulp & Timber Limited
Roger Keery	TimberWest Forest Limited
TBA	MacMillan Bloedel Limited
Ken McClelland	WRCLA
Ron Neilson	Forintek Canada Corp.
Paul Perkins	Weyerhaeuser Canada Ltd.
Mark Phillips	International Forest Products Limited
Ron Small	Vancouver Island Assoc. of Wood Processors
J. Trask	Canadian Forest Products Ltd.
Terry Upgaard	Slocan Group
Brian Zak	CFLA/Zairai Promotion Group